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# On Image Processing: Application of Arithmetical Operators for Image Enhancement and Blending of Images

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**Abstract:** Image enhancement can be done using various procedures. Arithmetic can be applied using various operators for the purpose of image enhancement. The operators are applied on single image or on two or more images to produce the enhanced resultant image. Basic arithmetic is applied on the images and pixel-by-pixel operations are performed. The output image Pixels depends only on the values of the corresponding pixels in the input images. Due to this reason the input images are required to be of similar in size. Here, basic operations on grey-scale image are performed and using canny-edge detection, the obtained image is blended with another image. The output of blending operation provides better and sharp image output compare to the addition operation of two images.

**Keywords:** *Image Arithmetic, Saturation of Image, Wrapped Image, Blending of Image.*

## I. Introduction

Image arithmetic is applied on one or more images. It applies standard arithmetic operations like plus, minus, multiplication, division etc. or logical operations. This arithmetic is applied in each pixels of the image on pixel to pixel form. The resultant image output is depending on the values of the corresponding pixels in the input image. To perform the arithmetic on image, it is necessary to have the images of same size. On single image the image arithmetic can be applied using addition of constant offset. Image arithmetic is the very basic form of image processing. Different range of image applications are possible. The biggest advantage of arithmetic operators is that the process is very simple and comparatively very fast.

One of the important applications of processed images can be, taking images from the same scene at different points of time. The application is reduction of random noise by adding successive images of the same scene or motion detection by subtracting two successive images.

Another kind of operators used are Logical operators. They are mainly used to combine two binary images. In the case of integer images, the logical operator is normally applied in a bitwise fashion. Then we can, for example, use a binary mask to select a particular region of an image.

In case of addition implementation, this operator takes as input two identically sized images and produces as output a third image of the same size as the first two. In this process, each pixel value is the sum of the values of the corresponding pixel from each of the two input images. In sophisticated versions, it allows more than two images to be combined with a single operation.

Addition of two images takes as input two identically sized images and produces a third image of the same size as output. Each pixel value is the sum of the values of the corresponding pixel from each of the two input images. More sophisticated versions allow more than two images to be combined with a single operation.

 

When addition or multiplication is performed between two images, the resultant image produced is either very dark or bright due to saturation and wrapping problem of image. To overcome this problem an alternative method called blending of method is used and then the result is compared with the result obtained by performing pure addition and multiplication.

The pure addition or multiplication of images provide resultant image but, compare to that if the blending of image is performed it can fetch better result. This research study is based on performing blending of image and then comparing the resultant image with the image obtained by pure addition of similar two images.

## II. Methodology:

The images used for comparison of addition and blending are uniform grey-scale iamge which are 8-bit images.

There are two methods of adding images.

**Method-1:** The addition of two images is performed straightforwardly in a single pass.

$$Q(i,j) = P_1(i,j) + P_2(i,j)$$

**Method-2:** Add a constant value *C* to a single image.

$$Q(i,j) = P_1(i,j) + C$$

Pixel values in the input images are actually vectors and not scalar values. For example, for color images the individual components are red, blue and green components.

Most of the background pixels are greater than the possible maximum (*255*) and therefore are (with this implementation of addition) wrapped around from zero. Wrapping pixel values exceeding the maximum value are set to *255* (using a hard limit). This problem is referred as saturation and wrapping of pixel values. The resultant image obtained is either obtaining either very dark or very light image.

The wrapped image produced is

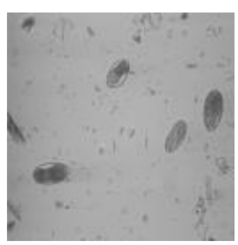

**Fig-1: Original Image**

 

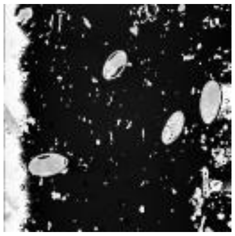

**Fig.2:Wrapped Image**

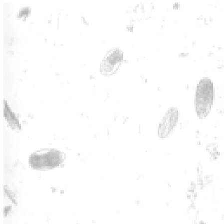

**Fig.3: Wrapped Image**

One approach used to overcome the problem of wrapping of image is to apply combination of multiple operators to gain the resultant image.

The original image is applied with two different operations. The first operation is to multiply the image with the constant value 1.3.

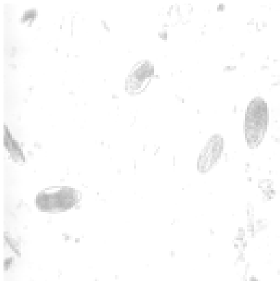

**Fig.4: Original Image**

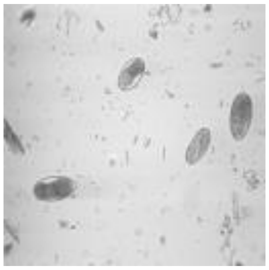

***Fig.5:Resultant image where multiplication constant is C=1.3***

Another approach is to scaling the image. Here, the original image is multiplied by 0.8 and then adding constant value 100. The following result is obtained.

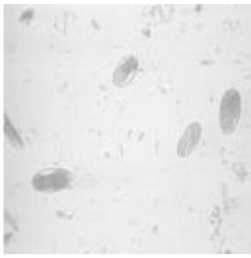

***Fig.6 Resultant image where multiplication constant is C=0.8 and addition of constant 100***

Here, the result image is much clearer. However, this cannot be applied in general to all images in process to obtain the final result.

**Blending of Image:**

Blending of image is another sophisticated way of obtaining merged image. In case of merging two images, the blending process is used and it ensures that merging two images results does not result into saturation. In case of applying blending with color images, it is important to consider that the color information has been encoded.

Consider two digital images $P_1$ and $P_2$. Both the images are of same size grey-scale images. Image $P_1$ is denoted as $P_1(i,j)$ where, i and j are corresponding pixel position of images $P_1$ and $P_2$.

$$Q(i,j) = X \times P_1(i,j) + (1-X) \times P_2(i,j)$$

Applying blending process applying above formulae, the first image P1 is multiplied with an offset X . The X is also called blending ration. It determines the influence of each input image into output. The value of X is considered between 0 and 1.

In process to perform blending on image, we have taken two images. The first image is the original image which is an object having dark background over a light background. Here, we use image blending to overlay the output of an edge detector on top of the original image and compare with the results achieved with image addition.

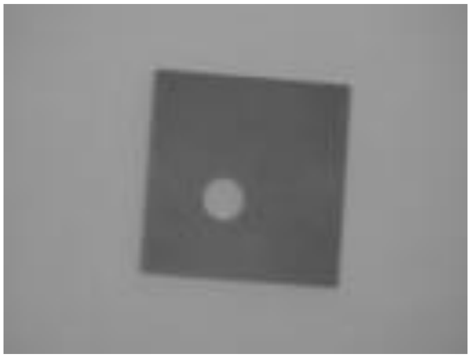

 

**Fig.7 :Original image using for blending**

The above image is having dark object above a light background. By applying Canny edge detector, another image of similar size is obtained.

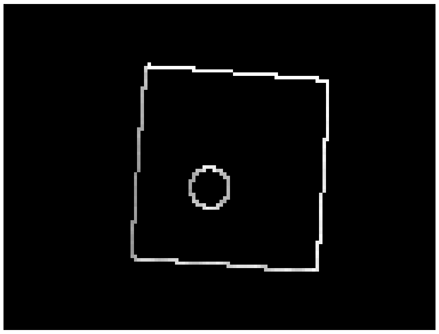

***Fig.8: Image obtained by applying Canny-edge detector***

Now, considering the blending factor X=0.5, and applying blending on both the images, we obtained following resultant image.

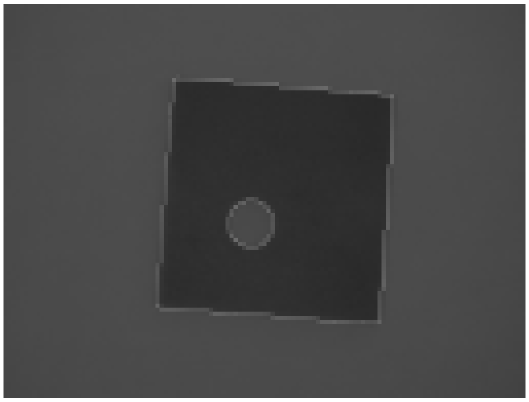

**Fig.9: Obtaining output image for X=0.5**

Now, applying blending ratio X=0.7 we can obtain following output image.

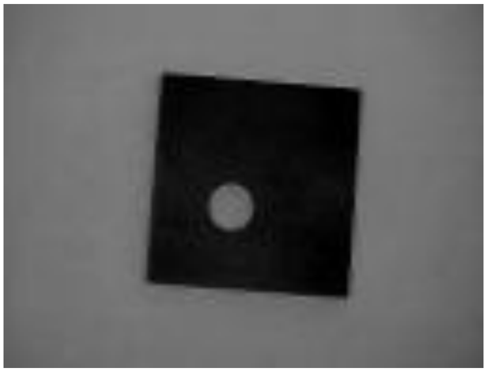

**Fig.10: Obtaining output image for X=0.7**

The input images were contrast-enhanced with contrast stretching and then blended with $X = 0.7$

## III. Results and Discussion

Since both the input images are scaled with 0.5 before the blending of image is applied, the contrast of both the image is halved. Due to this, it is observed that the background and foreground object have much visible contrast. As per the blending operation, the X=0.5 and thus, the 1-X = 0.5. This shows that the blending applied to foreground and background is at same ratio. Similarly, by applying X=0.7, the obtained output image is having better contrast clarity . In this case, the foreground object is applied with X=0.7 blending factor and the background portion is applied with (1-X)=0.3.

## IV. Conclusion

By applying X=0.7 blending factor to the foreground object results into better contrast visible output compare to the X=0.5 blending foreground factor on the same image. It is visible that by blending the image with proper blending factor, results into comparatively better output. This image is identical to the one achieved with image addition, but with better clarity. This is comparatively simpler process. Blending can also be used to achieve nice effects in photographs.

## References

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