



**Republic of Iraq
Ministry of Higher Education
And Scientific Research
University of Babylon
College of Sciences for Women
Computer Department**



Enhancement Blur Image

A project submitted to the Council of the College of Science for Women at the University of Babylon, which is part of the requirements for obtaining a bachelor's degree in computer science

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إقرار المشرف

اشهد ان اعداد هذا المشروع (Enhancement Blur Image)

قد جرى تحت إشرافي في قسم علوم الحاسوب / كلية العلوم للبنات / جامعة بابل
وهو جزء من متطلبات نيل شهادة البكالوريوس في علوم الحاسبات من قبل طالبة
المرحلة الرابعة (هدى فلاح حسن حمزه) للعام الدراسي ٢٠٢٢ - ٢٠٢٣

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المرتبة العلمية: مدرس

التاريخ :

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿ فَتَعَالَى اللَّهُ الْمَلِكُ الْحَقُّ وَلَا تَعْجَلْ بِالْقُرْآنِ مِنْ قَبْلِ أَنْ يُقْضَىٰ

إِلَيْكَ وَحْيُهُ وَقُلْ رَبِّ زِدْنِي عِلْمًا ﴾

صدق الله العلي العظيم

سورة طه \ آية ١١٤

الشكر و التقدير

بسم الله الرحمن الرحيم

الحمد لله رب العالمين والصلاة والسلام على أشرف الخلق محمد وآله الطيبين
الطاهرين

لأ يسعني وأنا أختتم دراستي هذه إلا أن أتقدم بالشكر والعرفان الى الاستاذ المشرفه
(م. زهراء جبار حسين)

لما قدمت لي من التوجيهات القيمة والملاحظات السديدة التي أنارت طريق
الباحث فجزاها الله عني خير الجزاء

كما أتقدم بخالص الشكر لأساتذتي الكرام في قسم العلوم للذين بذلوا جهودهم خلال
السنوات الاربعة الماضية

والى كل من مد يد العون والمساعدة بقلب صادق

الاهداء

من لم يشكر المخلوق لم يشكر الخالق

بسم الله الرحمن الرحيم

أحمد الله تعالى حمدا كثيرا طيبا مباركة ملئ السماوات والأرض على ما أكرمني به من إتمام هذه الدراسة التي أرجو أن تنال رضاه اهدي تخرجي وابعث شكر لكل هؤلاء الأشخاص الذين ساهموا بتسهيل وتمهيد طريق نجاحي:

- يا امام العصر بأي لغة أشكرك، وبأي ثناء أتقدم لك به، وأي نثر هذا الذي أثنى عليك به فيوفي حقك امام الزمان(عج) الذي لو له لم أستطيع السير في درب النجاح ولم اتعدي لحظات النهيار والفشل.

- اشكر ابي وامي اني مدين لكما بكل ما وصلت إليه وما أرجو أن أصل إليه من الرفعة ثقة الوالدان بابنتهم هي أول خطوات نجاحها شكرا أبي شكرا امي.

-يجب عليه ان لا أنسى من كانوا سببا في نجاحي مهما تقدمت وفتحت أمامي الطرق ووصلت لكل ما احلم به، هم من ساندوني ووقفوا إلى جانبي وحفزوني ودفعوا بي إلى الأمام، الأشخاص الذين دعوا الله لي.

Abstract

Images play an important role in computer applications, so there is an urgent need to perform image-processing operations, and image processing is intended to perform some mathematical operations that result in a new form of the image, such as rotation, zooming in and out, lighting control, contrast, coloring, improving images, removing noise from them and many other operations. Most websites need pictures to publish information, and most shops and markets need advertisements that are fed with pictures that are clear to people passing by Enhancement techniques have two types: frequency enhancement and spatial enhancement. The enhancement we adopted in our research is the spatial enhancement represented in processing image pixels. In addition to relying on the NTSC color space as part of the image processing and then making a normalization of the image depending on the values converted to the NTSC color space and we used Sharpness filters that make the contours of the image clearer, defining the edges of the image.

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Chapter one

1.1 Introduction:

Image degradation due to motion blur is caused by a relative motion between the camera and the scene during the image integration time. This degradation is particularly significant when long exposure times are needed, for instance, in low-light conditions or insight-dynamic-range (HDR) imaging. Several solutions to image blur degradation have been proposed. If there is a blur point spread function (PSF) that is constant over the image and that is known, the original image of the scene can be restored, to some extent, by applying an image de-convolution routine. In such a case, the key challenge in restoring the original image is caused by the zeros of the PSF in the frequency domain, resulting in lost spatial frequencies in the original image. However, in most practical situations, the motion blur PSF is not known, and since it depends on the arbitrary camera motion during the exposure time, it is also different for each image. One can use blind de-convolution approaches to restore the motion-blurred images [2, 3]. Unfortunately, most such methods, such as camera phones, are computationally prohibitive for consumer devices with limited computational resources. Measurements of the camera motion during the exposure time could help estimate the motion blur PSF and eventually restore the scene's original image. Ezra and Nayarit [4] used a secondary video camera to estimate the motion during the exposure time of the principal camera. Others have estimated the PSF [5, 6, and 7] from a second image with short exposure. Although noisy, the secondary image is much less affected by motion blur, and it can be used as a reference for estimating the motion blur PSF which degraded the principal image. However, objects such as people may move even if the camera is completely stationary during the image capture. This results in a spatially variant blur PSF making the restoration problem much more difficult, not even impossible with the current technique. We propose a solution based on fusing visual information in two differently exposed images: a short-exposed image affected by noise and a long-exposed image that may be affected by motion blur. Unlike the earlier solutions [5, 6, and 7], our result is obtained without de-convolving the long-exposed image, which would be too computationally expensive for some devices and infeasible for a spatially varying PSF. Our method can deal with camera and object motion blur in the long-exposed image. Our image fusion method gathers the desired visual properties from noisy and blurry images into a final, higher-quality picture.

The image improvement stage is considered one of the important and most common processing steps in digital image processing. Image improvement techniques are

used by removing noise, adjusting colors, or adjusting the intensity of lighting. image enhancement techniques is to process any image so that the resulting image is better than the image enhancement techniques is to process any image so that the resulting image is better than the distorted image for a specific application. Despite the recent spread of the issue of image enhancement, we find that today it is used in a variety of ways, including:

Researchers in the field of digital image processing and improvement

- ✚ Photographers, when they take pictures, need to improve.
- ✚ The military drew the battlefields and prominent perseverance and defined the military areas and infrastructures to be protected.
- ✚ Geographers in maps, topography, mountains and plains.
- ✚ The two archaeological sites in identifying the archaeological areas.

- ✚ Designers in all fields, fashion designers and workers in decorations and other design fields.
- ✚ In the medical field, for example, in medical imaging.
- ✚ In astronomy, defence, space and biology.

1.2 Research problem:

Some images are unclear and contain noise represented by Blurry, Low light, or noise caused by passing through the transmission channels, so their features are unclear and need an improvement process. The problems in the pictures are the blurry noise and the low resolution, degraded image by taking a corrupted/noisy image and eliminating and correcting errors.

1.3 Research Aims:

Optimizing the captured image of the shape according to the intended purpose, one of the important purposes is to purify the image from noise, which is caused for several reasons, such as the camera's sensitivity or during the transfer and storage of the image. The image is also improved by reducing or removing blur from the image. One of the important things before processing the image is correcting and redistributing colors and lighting. This is done in several ways, such as evenly distributing color tones and increasing or decreasing contrast and brightness.

1.4 Types of Noise:

1. **Salt and pepper noise:** Randomly scattered black + white pixels



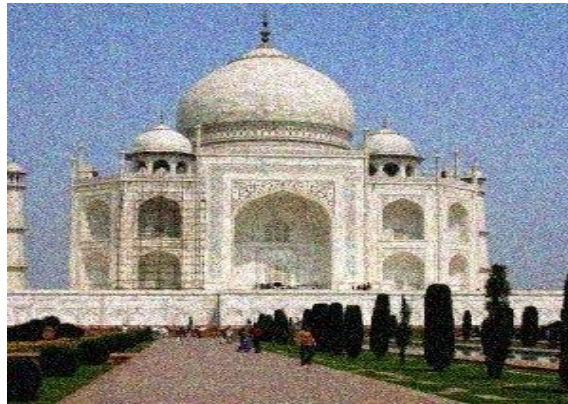
2. **Mules noise, shot noise or binary noise:** random occurrence of white pixels



3. **Gaussian noise:** The idealized form of white noise added to the image, variations in intensity drawn from a Gaussian normal distribution.



4. **Speckle noise:** pixel values multiplied by random noise. $I(1+\text{Noise})$



5. **Periodic noise:** caused by disturbances of periodic nature Salt and pepper, Gaussian and speckle noise can be cleaned using spatial filters.



1.5 Three Views of Filtering:

- **Image filters in the spatial domain**

Filter) is a mathematical operation of a grid of numbers(Smoothing, Sharpening, measuring texture

- **Image filters in the frequency domain**

Filtering is a way to modify the frequencies of images. DE noising, sampling, image compression

- **Templates and Image Pyramids**

Filtering is a way to match a template to the image Detection, course-to-fine registration

1.6 Research planning:

Chapter Two (Enhancement Filters): It deals with the concept of enhancement and the methods used to improve images and their types.

Chapter Three (practical side): explains the proposed improvement system.

Chapter Four: It includes conclusions, proposals and sources

Chapter Two

2.1 Introduction:

Image processing faces challenges ranging from uneven resolutions, coordination differences, irregular lighting, distortions and noise. It is also affected by directional differences and variance. Because of these challenges, most digital image processing applications or devices use optimization procedures before using the captured image for its intended purposes.

2.2 Image optimization:

Image enhancement aims to produce an image that contains noise, and the image whose details are highlighted is better than a faded image with unclear details, and so on. Image improvement depends mainly on one of two basic techniques: spatial domain processing and frequency domain processing techniques.

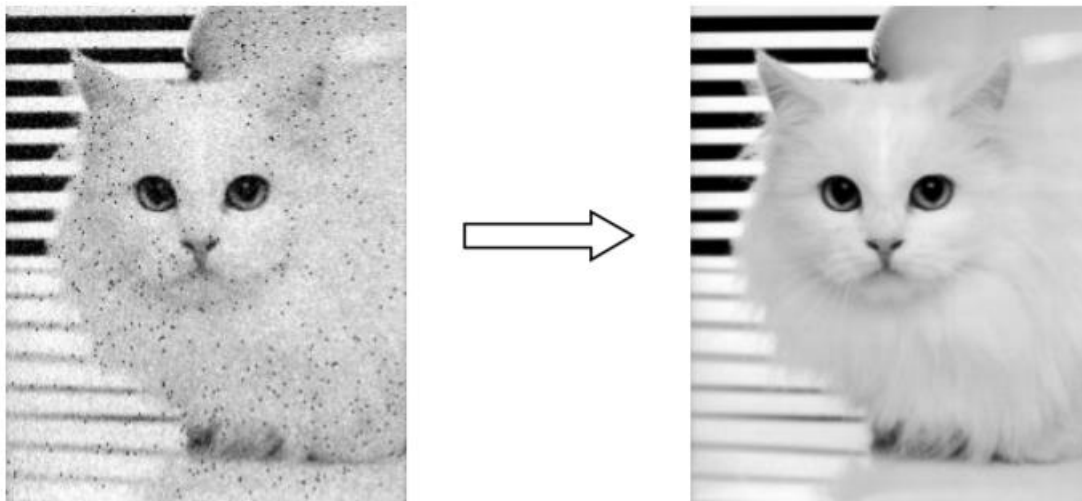


Figure (2.1) Image enhancement

Image enhancement techniques are divided into two main parts: Frequency domain: It deals with the image based on a matrix of frequencies (signals). The mathematical transformation of the image is handled like (DFT, DCT, and DWT).

Spatial domain (spatial technologies):

It deals with the image based on a matrix of image elements (pixels). It deals with the image itself.

Anyone can deal with image enhancement techniques, either by relying on processing points whose intensity of pixels is without relying on the nature of their neighbors or by relying on the window, which is also called the mask. The window is defined as a partial image. It is used in local processing to modify each point in the image to improve it.

Enhancement Image in Domain Spatial The term spatial domain refers to adjacent points that make up the image and spatial domain methods are procedures that operate directly on those points. The following equation can express the spatial domain:

$$G(x, y) = T [F(x, y)]$$

Whereas:

Image input : $F(x, y)$

$G(x, y)$: Enhanced image

T: A factor of F defines some contiguous ones.

The working method for this type defines the adjacent sites (x, y) using a square or rectangular window whose center is (x, y) . (x, y) to produce G for that location .

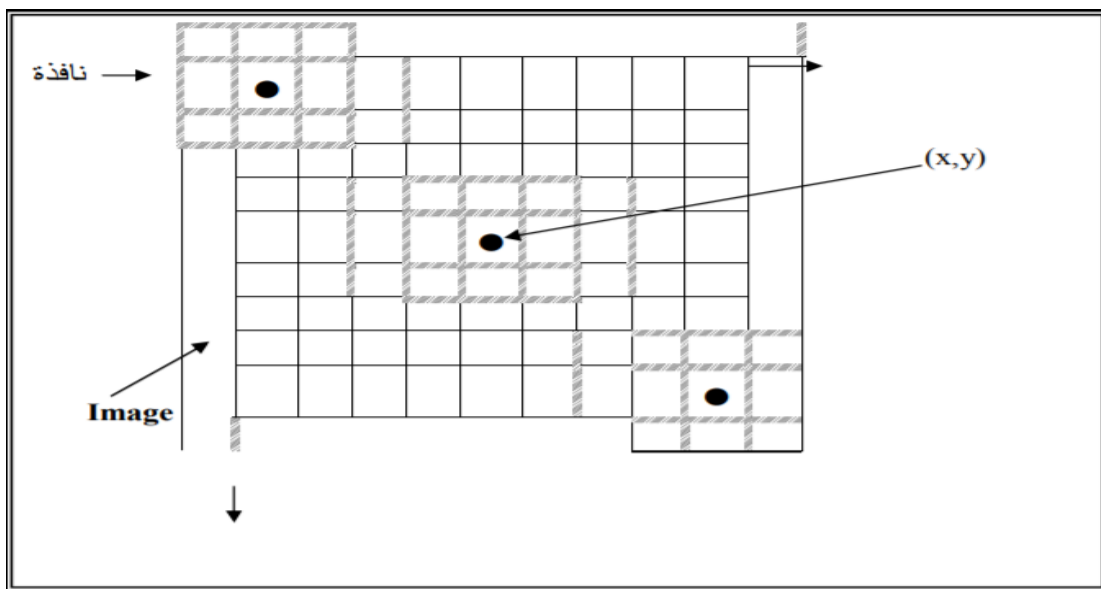


Figure (2.2) a 3 * 3 window with center (x, y) in the image

Figure (2.2) shows that some points are lost to adjacent ones, especially if the centre of the point is located on the border (frame) of the image, as in the upper left corner and the lower right corner, where there are adjacent points that are not part of the image. Processing such contiguous ones requires padding the image frame, usually with zeros (s'0) values.

These functions process the points located on the borders (frame) of the image by assuming that rows and columns of zeros surround the image. These added rows and columns do not become part of the output image but are only used as parts of the contiguous points of the actual image. Color image filtering (true color image) A color image can be represented by three two-dimensional arrays, one for each color (Red, Green, and Blue (RGB)). Therefore, smoothing filters and others can be applied to a matrix, each color separately, and then combine the results of the three images to obtain the improved color image.

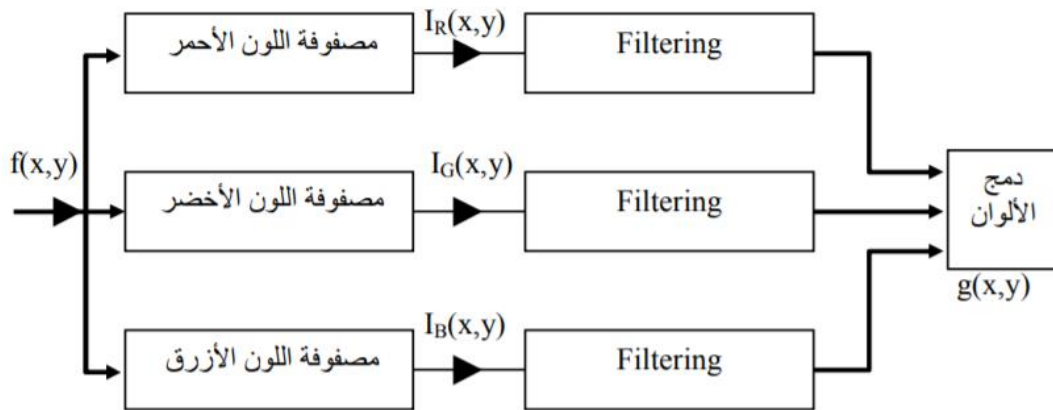


Figure (2.3) Color image filtering

2.3 RGB color image:

Three numerical matrices represent the color image in the computer. Each pixel within the image is described by three numbers, each of which refers to one of the

three components. Depending on the color space used, there are several ways to store the image in the computer.

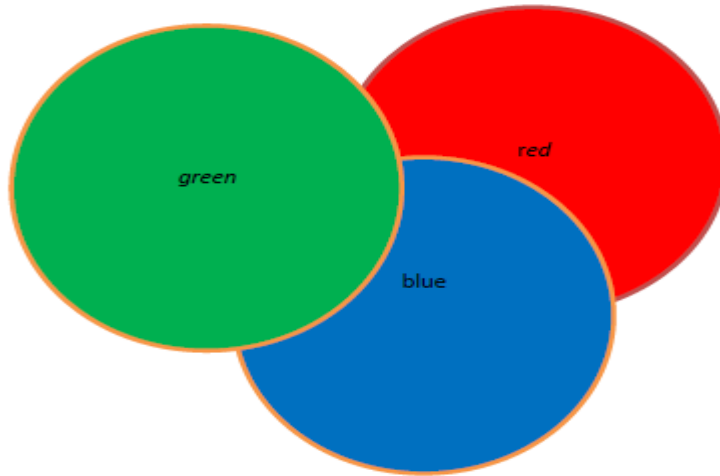


Figure (2.4) Chromatography, RGB

2.4 Color space:

The color space combines all the colors a pixel can contain within the image, so it is possible to classify any color given to each pixel. The most famous color space is RGB, where each pixel is described as a combination of three numbers representing how much red there is and how much color there is. Green and how much blue is there to represent a pixel. The image is improved using a set of commands, image, Adjust, and the most commonly used commands.

NTSC color space: Converts an RGB image's red, green, and blue values into the luminance (Y) and chrominance (I and Q) values of an NTSC image.

Convert from RGB to NTSC

$$\begin{array}{r} Y' \\ I \\ Q \end{array} = \begin{array}{ccc} 0.299 & 0.578 & 0.114 \\ 0.5957 & -0.2744 & -0.321 \\ 0.2114 & -0.5225 & 0.3111 \end{array} \begin{array}{l} R \\ * G \\ B \end{array}$$

Reverse conversion from NTSC to RGB

$$\begin{array}{r} Y' \\ I \\ Q \end{array} = \begin{array}{ccc} 0.299 & 0.578 & 0.114 \\ 0.5957 & -0.2744 & -0.321 \\ 0.2114 & -0.5225 & 0.3111 \end{array} \begin{array}{l} R \\ * G \\ B \end{array}$$

2.5 Sharpness filters:

Image sharpening filter refers to any enhancement technique that brings out edges and fine details in an image. Traditionally, linear filters have been used to implement the high-pass filter; however, linear techniques can produce unacceptable results if the original image is corrupted by noise.

The sharpening process works by first creating a slightly blurred copy of the original image, the unsharp mask. This is thrown away from the origin to detect the presence of edges. The contrast is then selectively increased along these edges with this mask - leaving behind a sharper final image.

So it is a technique to increase the sharpness of the visible image. ...subtracts a blurred copy of the original image to reveal any edges. Mask made of these details. Then the contrast increases at the edges, and the effect is applied to the original image.

Why do we need to sharpen the image?

There are three main reasons for sharpening an image: to overcome the blur introduced by the camera equipment, to draw attention to certain areas, and increase clarity.

When increasing clarity, there are many factors you need to take into consideration. The file's resolution, the final medium it will be rendered on, and the amount of detail in the image itself are all important considerations.

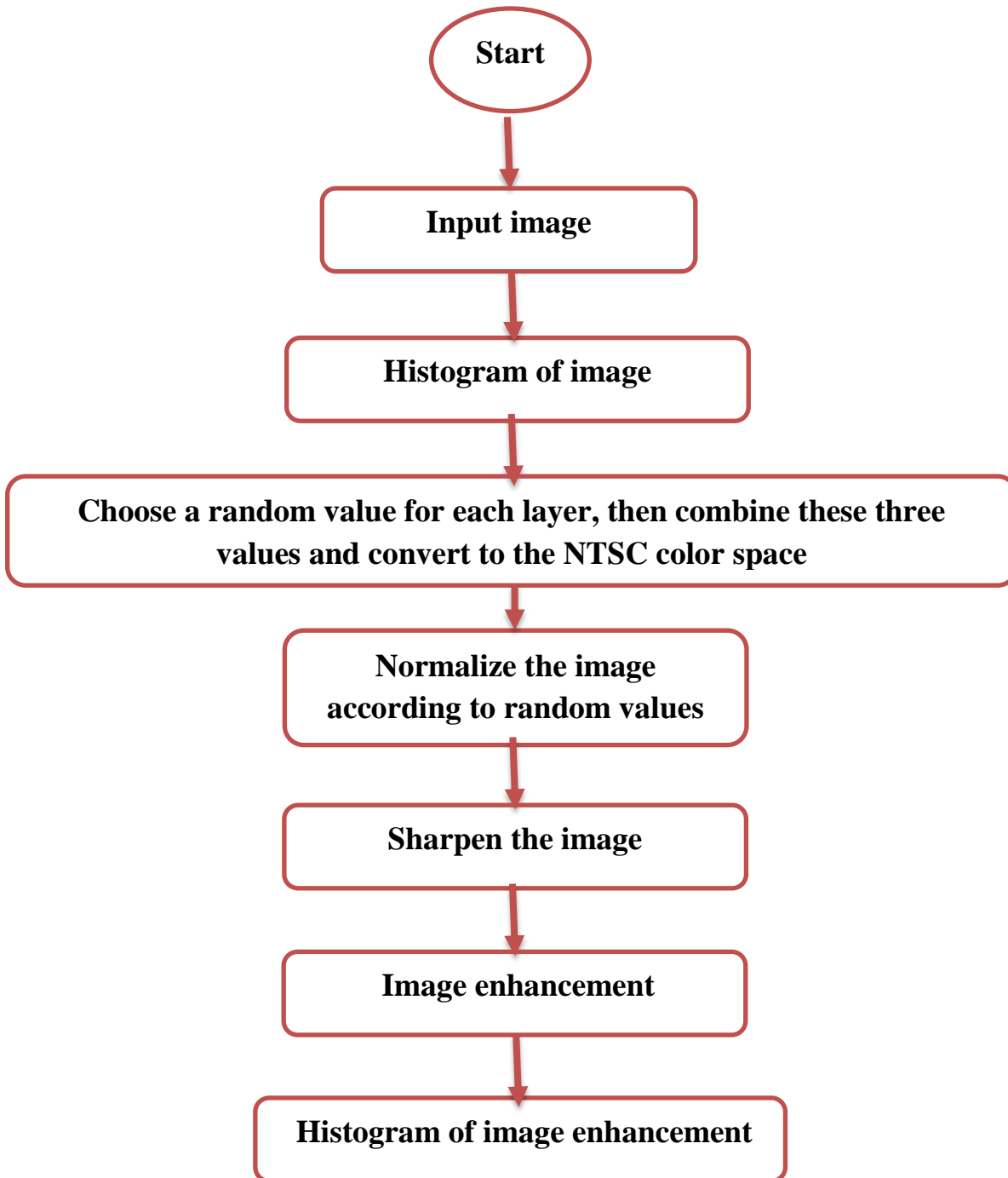
The Unsharp Mask sharpens an image by increasing the contrast along the edges of the image. The Unsharp mask does not detect edges in the image. Instead, it locates pixels that differ in value from those surrounding the border you specify. Then the contrast of neighboring pixels increases by the amount we specify. So, for neighboring pixels, lighter pixels get lighter, and pixels get darker. Additionally, you can specify the radius of the area each pixel is compared to. The larger the radius, the greater the edge effects.

Chapter Three

3.1 Introduction:

In this chapter, we will talk about a working mechanism that applies image optimization, as the language used is the MATLAB environment.

3.2 The proposed algorithm:



3.3 Explain the operation of the algorithm:

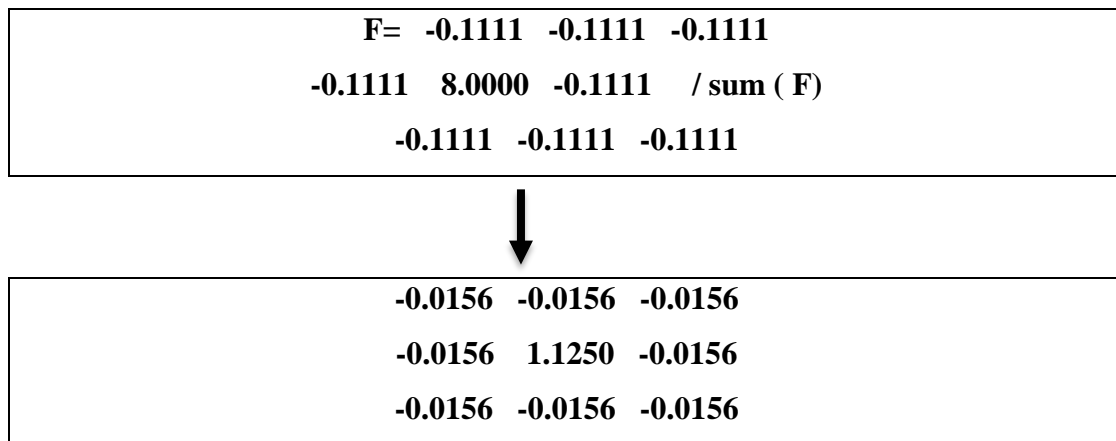
1. The image to be improved is read, and it is a color image that contains noise, whether it is low light, blurry, or both.
2. Finding the histogram of the input image to know the color distribution of the image.
3. Choose a random value for the image to represent the max value and choose another random value for the image as well that represents the min value, and then we convert those values to the NTSC color space.

rgb2ntsc [R1 G1 B1]

rgb2ntsc [R2 G2 B2]

$$im1 = \frac{im - \min(1)}{\max(1) - \min(1)} * 255$$

5. Use the Sharpen filter to sharpen the edges of the image.



6. Find the histogram of the resulting image.
7. Using the PSNR scale to measure the similarity between the images. Whenever the value is less than 50, this indicates that there is a big difference between the input image and the enhanced image.



Figure (3.1) the blurry image

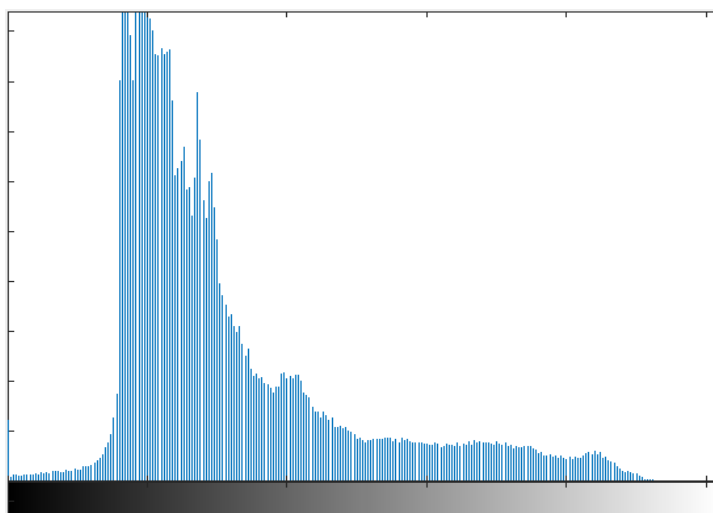


Figure (3.2) Histogram of the blurry image



Figure (3.3) shows the resulting image after the normalization process



Figure (3.4) Image after using the sharpness filter

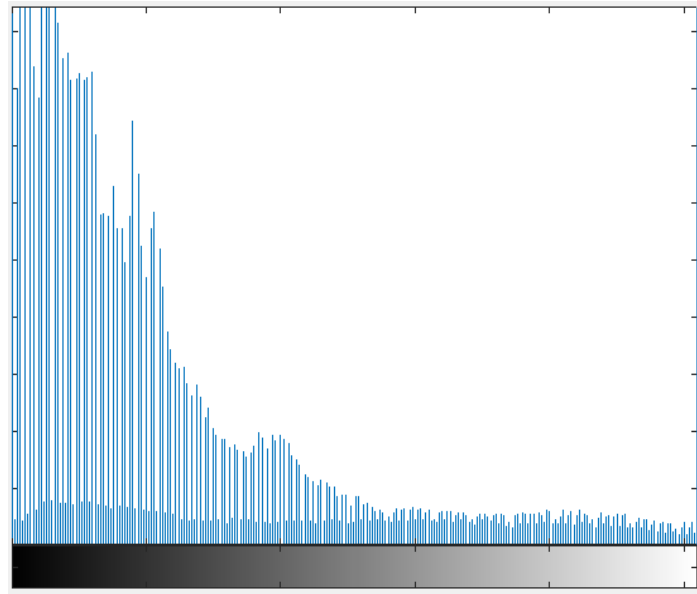










Figure (3.5) Histogram of the enhanced image

19.0779 =PSNR

Table (3.1) Inserted images and optimized images with PSNR scale.

Input Image	Image Resulting	PSNR
		<p>5.7372</p>
		<p>16.1083</p>
		<p>16.9323</p>
		<p>21.6368</p>



16.9746



14.9565



13.5659



16.0023

Chapter Four

4.1 Conclusions:

1. The proposed method improves the contrast of the dark image well.
2. Removing the blur from the images that contain blur. Images with high blur improve their contrast, but it is difficult to remove their Blur completely.
3. The parameters of the image were defined, so it was clearer
4. The spur value is low and indicates a large difference between the input and output images.

4.2 Proposals:

1. The use of convolutional neural networks in improving.
2. Using reciprocating filters to improve images.

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