American International Journal of Sciences and Engineering Research; Vol. 3, No. 1; 2020
ISSN 2641-0303 E- ISSN 2641-0311
Published by American Center of Science and Education, USA

Multimedia Image Processing Lab Experiment/Simulation

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Abstract
Image Processing in Multimedia Applications treats a number of critical topics in multimedia systems, with respect to image and video processing techniques and their implementations. These techniques include the Image and video compression techniques and standards, and Image and video indexing and retrieval techniques. Image Processing is an important tool to develop a Multimedia system design.

Keywords: Multimedia, Image Processing, Lab Experiment/Simulation.

1. Introduction to Image Processing

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.
Image processing basically includes the following three steps:

- Importing the image via image acquisition tools;
- Analyzing and manipulating the image;
- Output in which result can be altered image or report that is based on image analysis.

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction.

1.1 Application of Image Processing

Digital image processing has become economical in many fields like signature recognition, iris recognition and face recognition, in forensics, in automobile detection and in military applications. Each of these applications has its basic requirements, which may be unique from the others. Some of the important applications of image processing in the field of science and technology include computer vision, remote sensing, feature extraction, face detection, forecasting, optical character recognition, finger-print detection, optical sorting, argument reality, microscope imaging, lane departure caution system, Non-photorealistic representation, medical image processing, and morphological imaging

1.1.1 Advantages of Digital Image

The processing of images is faster and more cost-effective. One needs less time for processing, as well as less film and other photographing equipment. It is more ecological to process images. No processing or fixing chemicals are needed to take and process digital images. However, printing inks are essential when printing digital images. When shooting a digital image, one can immidiately see if the image is good or not. Copying a digital image is easy, and the quality of the image stays good unless it is compressed. For instance, saving an image as jpg format compresses the image. By resaving the image as jpg format, the compressed image will be recompressed, and the quality of the image will get worse with every saving. Fixing and retouching of images has become easier. In new Photoshop 7, it is possible to smooth face wrinkles with a new Healing Brush Tool in a couple of seconds. The expensive reproduction (compared with restoring the image with a repro camera) is faster and cheaper. By changing the image format and resolution, the image can be used in a number of media.

1.1.2 Disadvantages of Digital Image

ƒ Misuse of copyright is now easier than it earlier was. For instance, images can be copied from the Internet just by clicking the mouse a couple of times. ƒ the value of the image will get worse? This has not necessarily happened everywhere. Images held in image banks still have reasonably good prices, inspite of the fact that downloading images through the net is fast and easy. The profitableness of digital photography has increased the number of images and photography in general. ƒ Old professions (such as maker-up, repro cameraman) vanish, and new ones do not necessarily appear. For instance in mid-1990s, the newspaper Aamulehti started using computerised make-up, and the traditional makers-up were left unemployed. ƒ Work has become more technical, which may not be a disadvantage for everyone. ƒ A digital file of a certain size cannot be enlargened with a good quality anymore. For instance, a good poster cannot be made of an image file of 500 kb. However, it is easy to make an image smaller.

2. Research Objectives

To gain experience in processing digital images with point are processing and special processing to:-

- Improve its pictorial information for human interpretation,
- Render it more suitable for autonomous machine perception.
- To study basic image processing operation
- To understand image analyze algorithm
- Understand the basics of the human visual system as they relate to image processing; including spatial frequency resolution and brightness adaption.
- Understand why preprocessing is performed and know about image geometry, convolution masks, image algebra and basic spatial filters.

3. Theory/Procedure

Arithmetic operations: Fastly I have done arithmetic operations. These operations act by applying a simple function include adding or subtract or multiplying and division. Bellow shown the all figure

We can test this on the “blocks” image blocks.tif, which we have seen in figure . We start by reading the image in:

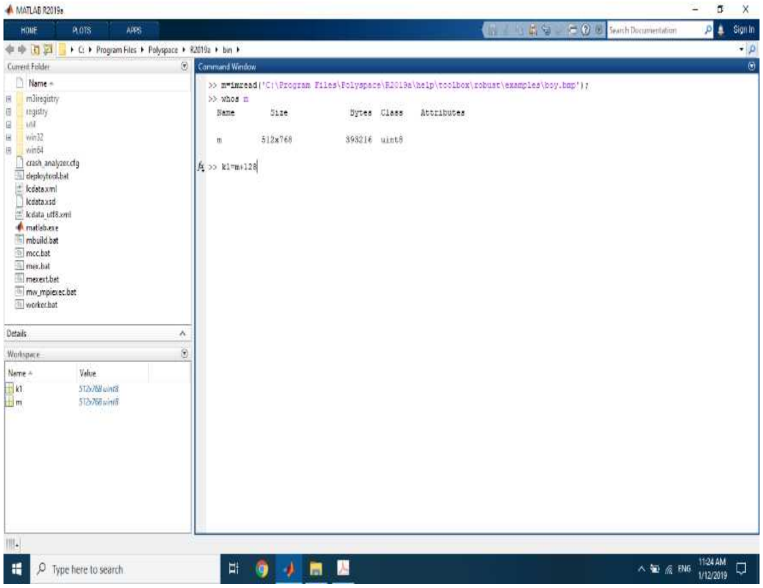


Figure: 1

The point of the second command was to find the numeric data type of b; it is uint8. The unit8 data type is used for data storage only; we can't perform arithmetic operations. If we try, we just get matrix:

>> b1=b+128

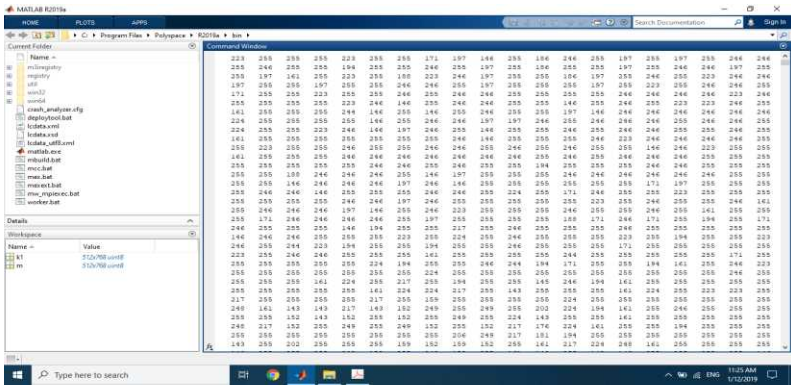


Figure: 2

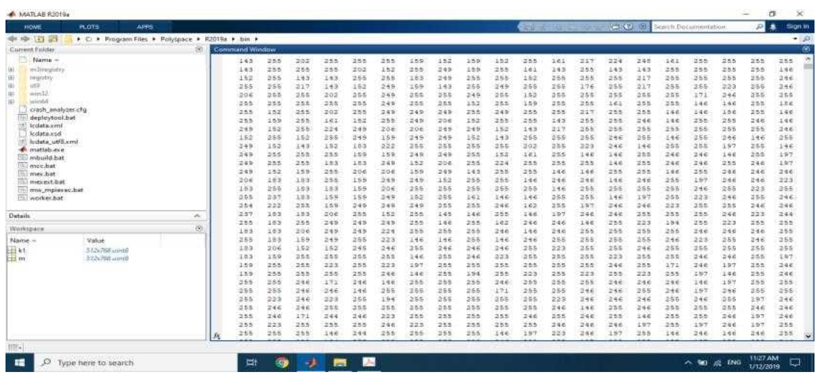


Figure: 3

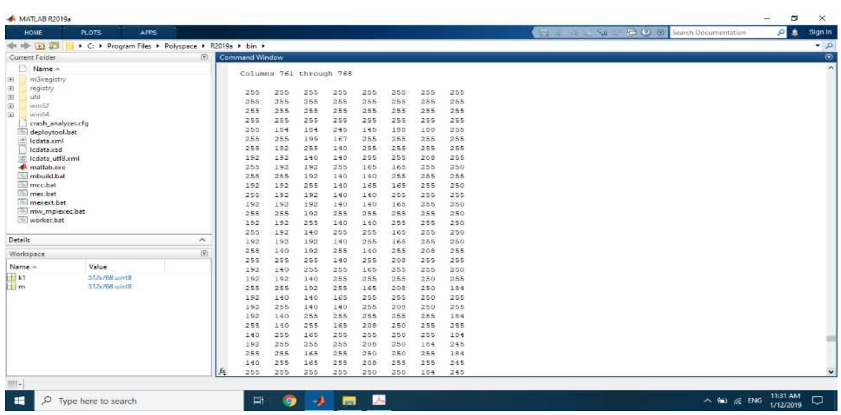


Figure: 4

I can get round this in two ways. I can first turn b into a matrix of type double, add the 128, and then turn back to uint8 for display:

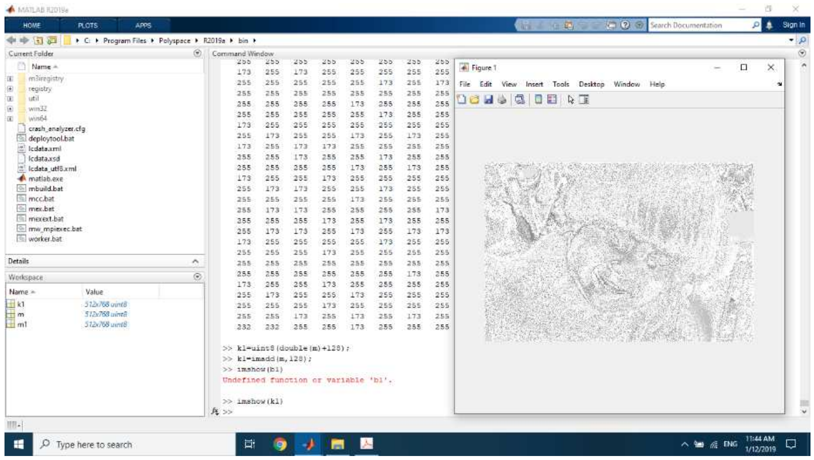


Figure: Adding

Subtraction is similar; I can transform out matrix in and out of double, or use the imsubtract function:>> b2=imsubtract(b,128); and the results is seen in figure

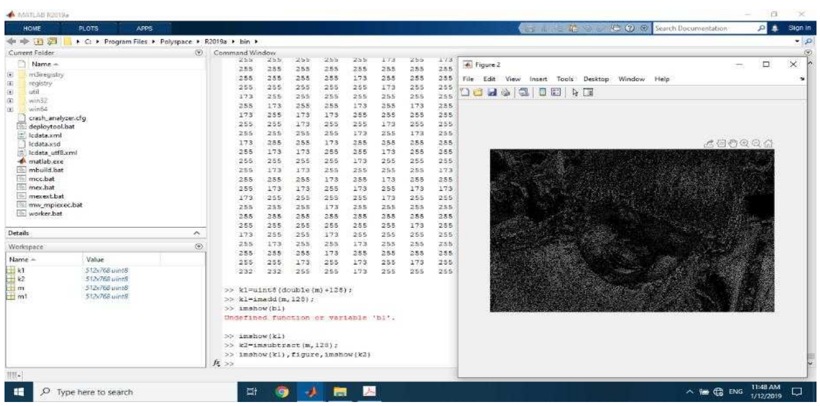


Figure: subtracting

I can obtain an understanding of how these operations affect an image by looking at the graph of old grey values against new values. I see that in general adding a constant will lighten an image, and subtracting a constant will darken it

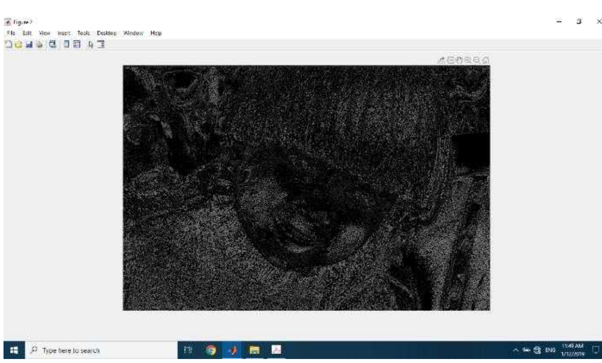


Figure: Subtracting 128

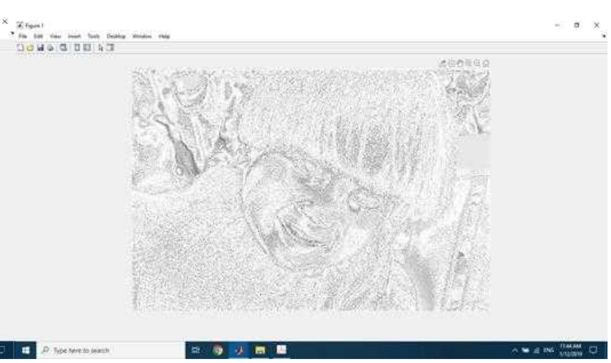


Figure: Adding 128

I can also perform lightening or darkening of an image by multiplication Compare the results of darkening b3 and b4. Note that b3, although darker than the original. All these images can be viewed with imshow, they are shown in figure

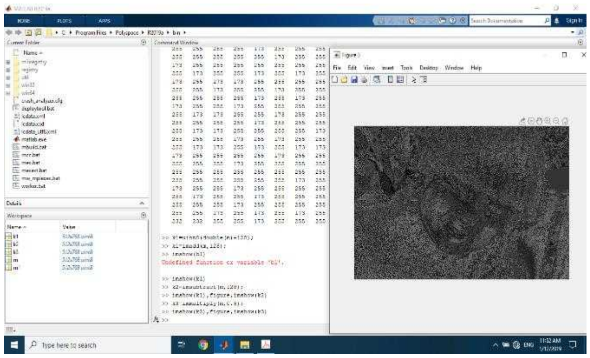


Figure: 3

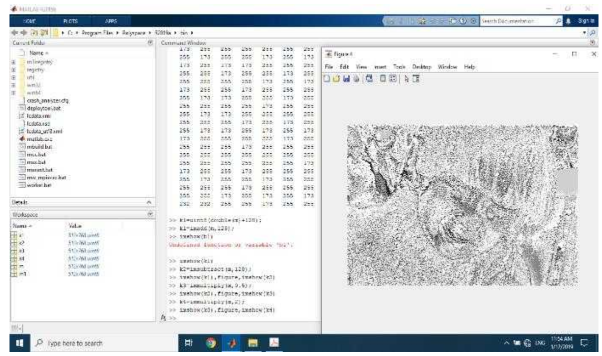


Figure: 4

A similar loss of information has occurred in the images k4 and k5. Note in particular the edges of the light coloured block in the bottom centre; in both k1 and k5 the right hand edge has disappeared. However, the edge is quite visible in image k5.

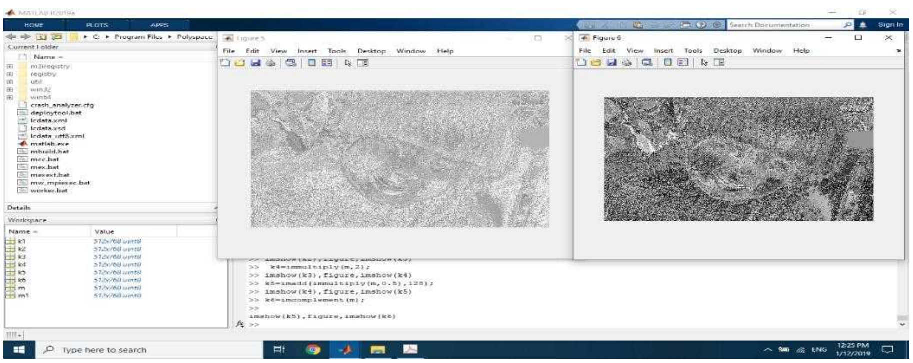


Figure: k5

3.1 Complements

The complement of a greyscale image is its photographic negative. If an image matrix m is of type double and so its grey values are in the range 0.0 to 1.0, we can obtain its negative with the command >> 1-m.

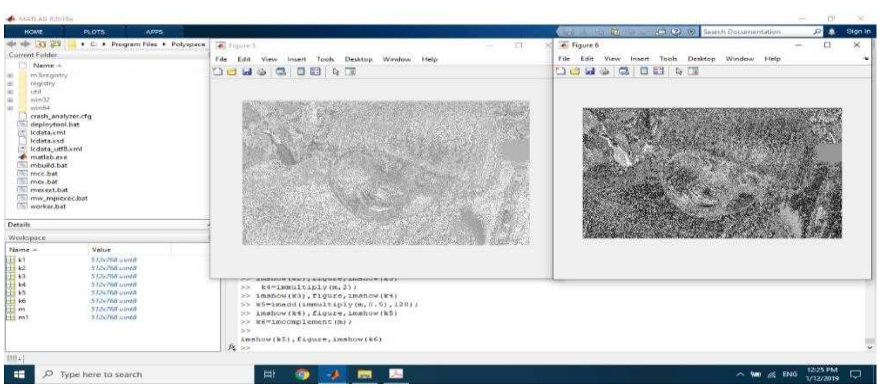


Figure: complement function

3.2 Histograms

Its histogram consists of the histogram of its grey levels; that is, a graph indicating the number of times each grey level occurs in the image.

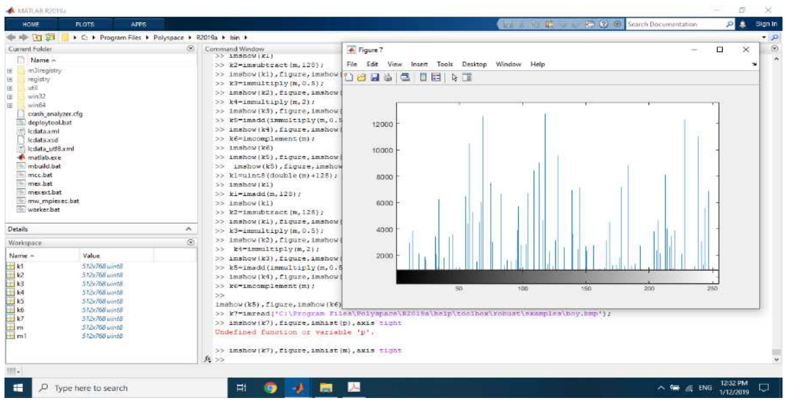


Figure: Histograms

3.2.1 Histogram Stretching and Plotting

Suppose i have an image with the histogram shown in figure, associated with a table of the numbers (ni)of the grey values.

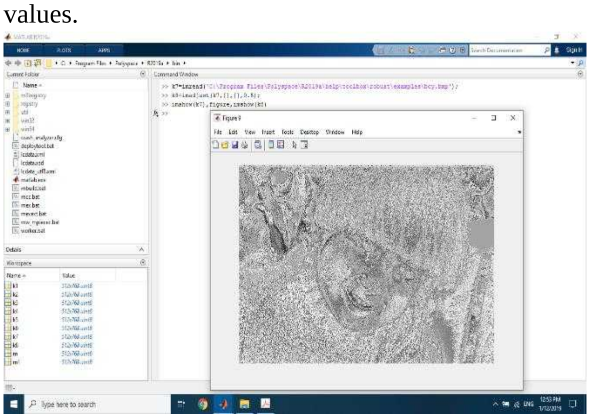


Figure: the image boy.BMP

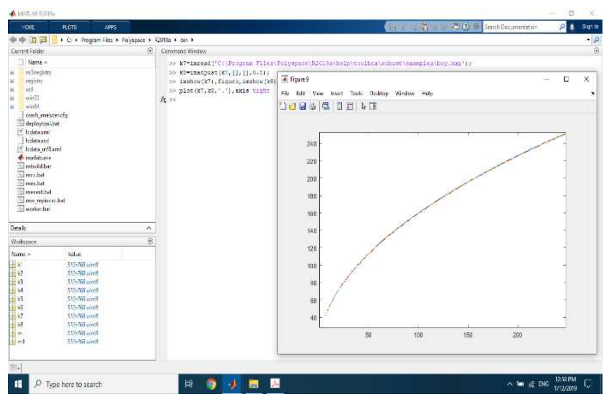


Figure: plot

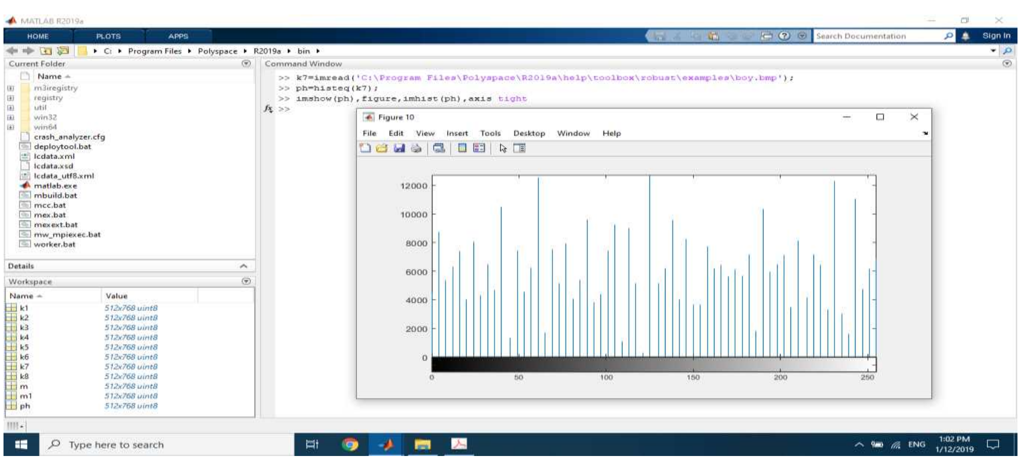


Figure: the histogram stretching

3.2.2 Histogram equalization

The trouble with any of the above methods of histogram stretching is that they require user input. Sometimes a better approach is provided by histogram equalization, which is an entirely automatic procedure.

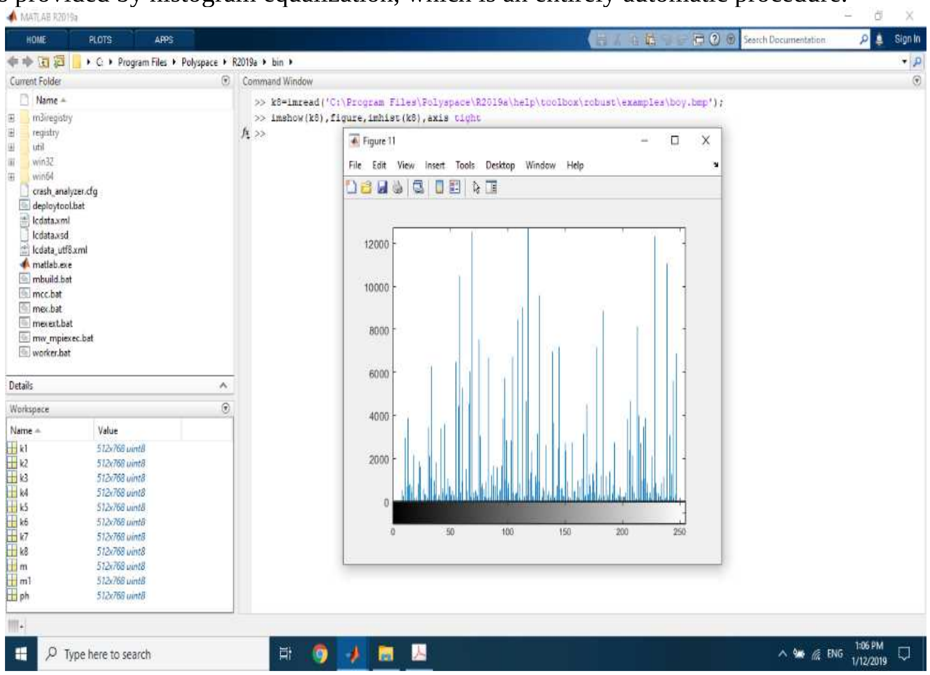


Figure: the histogram of figure after equalization.

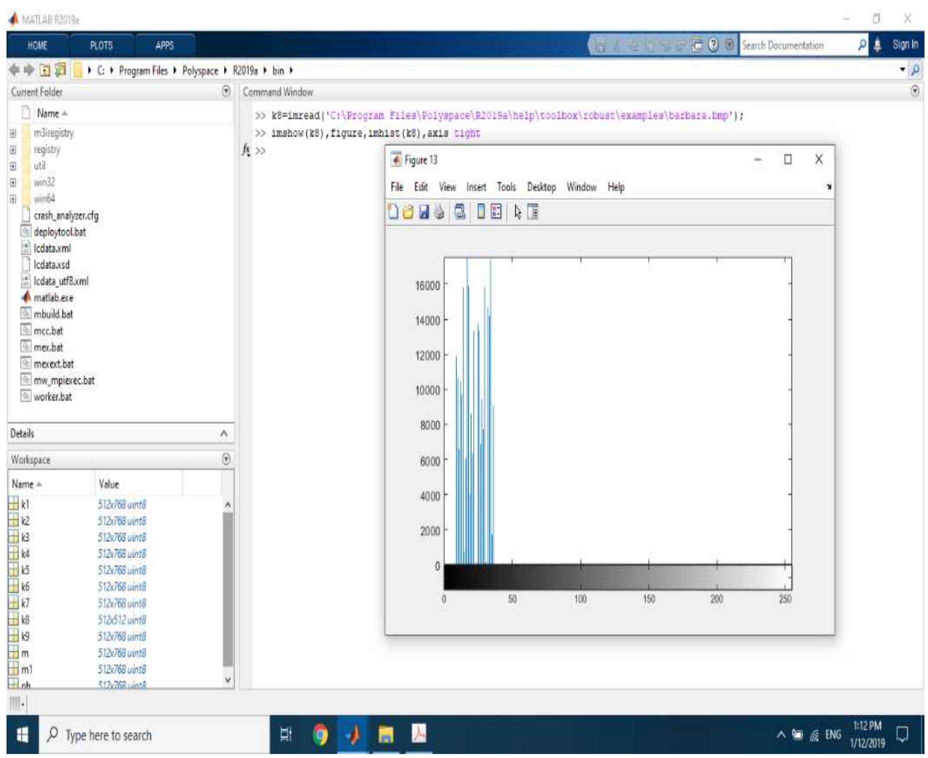


Figure: Histragram Stratching

3.3 Thresholding

Single thresholding: A greyscale image is turned into a binary (black and white) image by first choosing a grey level in the original image, and then turning every pixel black or white according to whether its grey value is greater than or less than T.

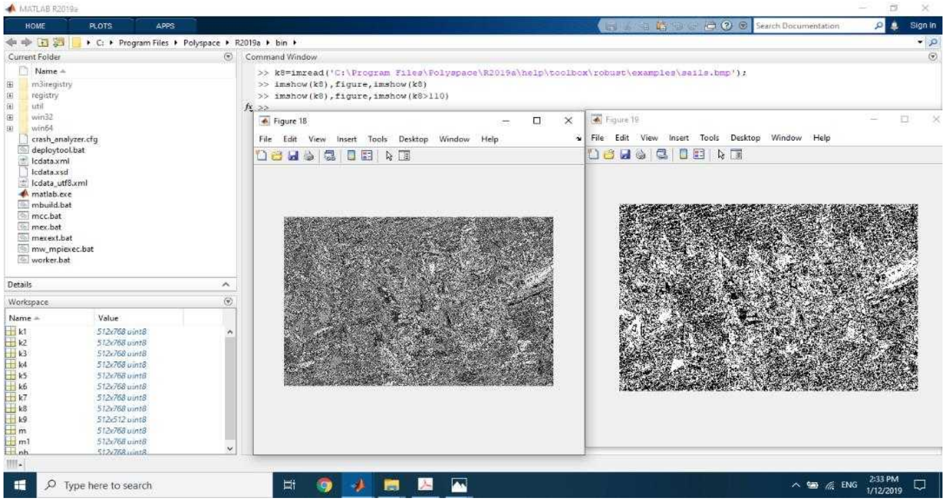


Figure: Thresholded image of sails.BMP

As well as isolating objects from the background, thresholding provides a very simple way of showing hidden aspects of an image. For example, the image appears Sails.bmp all white, as nearly all the grey values are very high. However, thresholding at a high level produces an image of far greater interest. provide the images shown in figure.

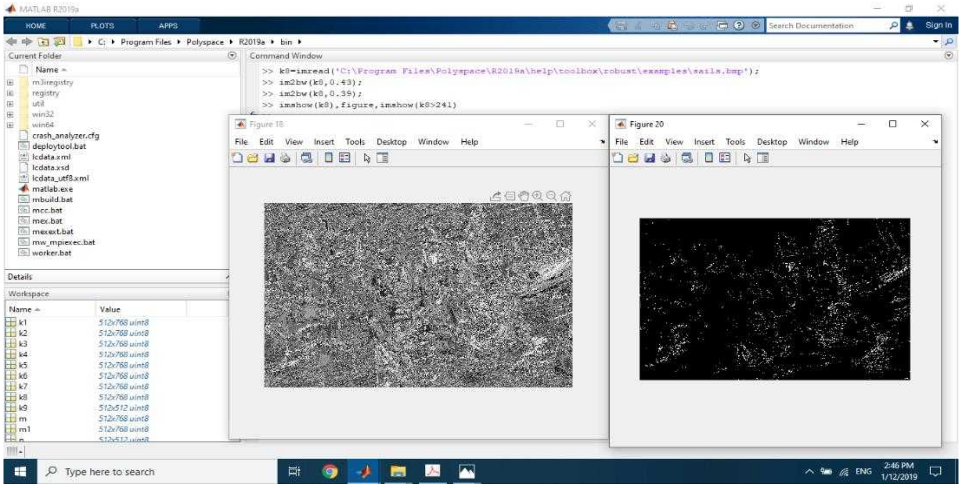


Figure 5.25: The paper image and result after thresholding

3.3.1 Double Thresholding

Here we choose two values T1 and T2 and apply a thresholding operation as:
X>T1 & X<T2.

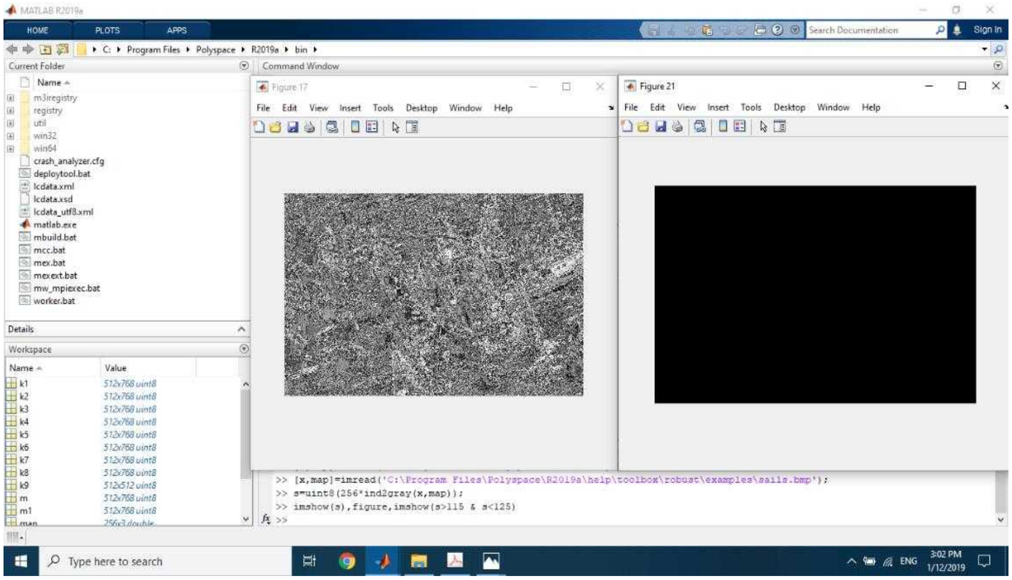


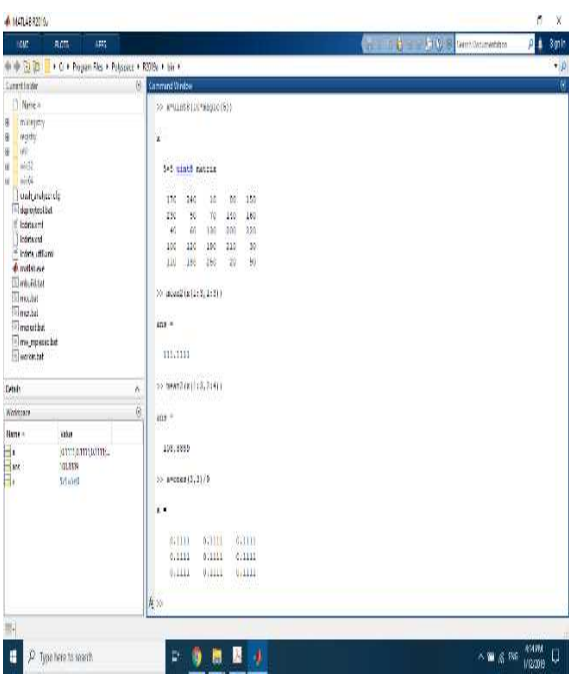
Figure: The image sails.bmp an the result after double thresholding

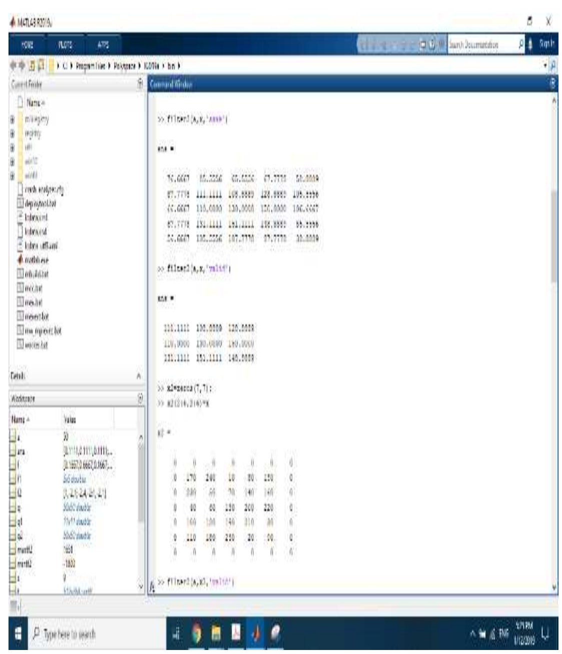
3.4 Spatial Filtering

I have seen in chapter 5 that an image can be modified by applying a particular function to each pixel value. Spatial filtering may be considered as an extension of this, where we apply a function to a neighborhood of each pixel. The idea is to move a "mask": a rectangle (usually with sides of odd length) or other shape over the given image.I see that spatial filtering requires three steps:

- Position the mask over the current pixel,
- Form all products of filter elements with the corresponding elements of the neighborhoods,
- Add up all the products

To apply this to an image, consider the 5 x 5"image" obtained by this image:





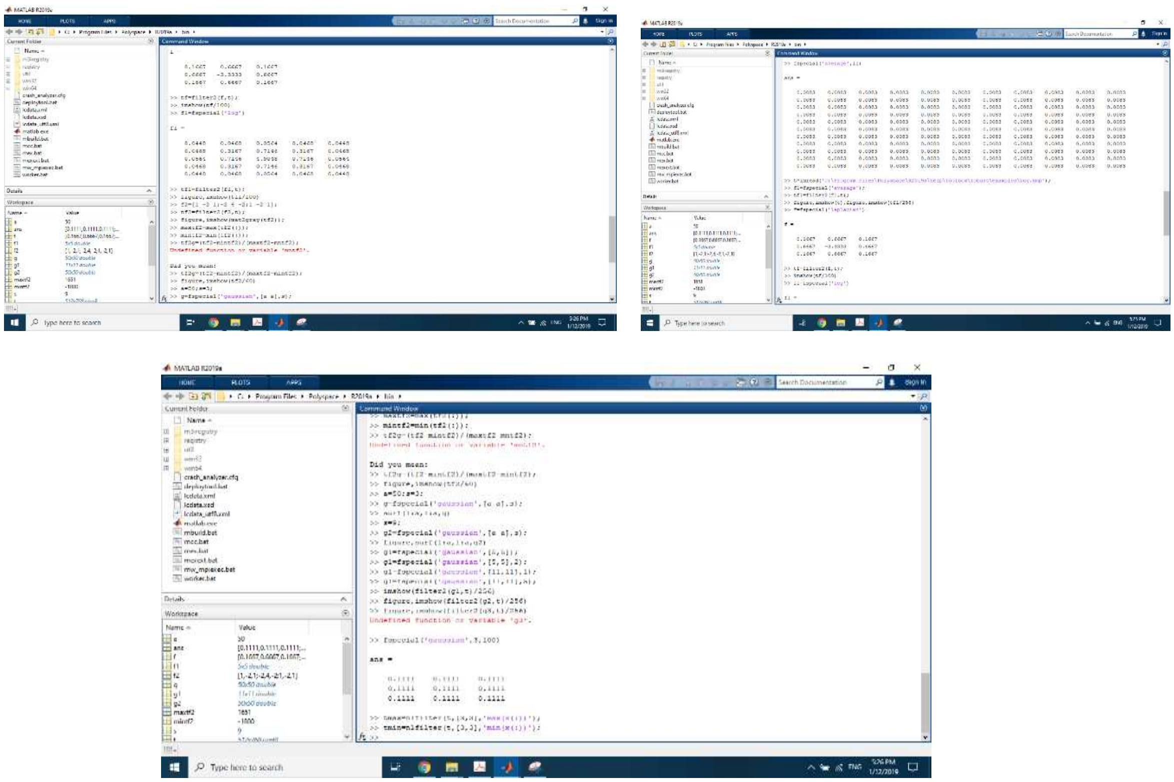


Figure: All figure about matrix

Fspecial('average',11) will return an averaging filter of size 11 x 11. If we leave out the final number or vector, the 3 x3 averaging filter is returned. For example, suppose we apply the 3 x3 averaging filter to an image as follows:

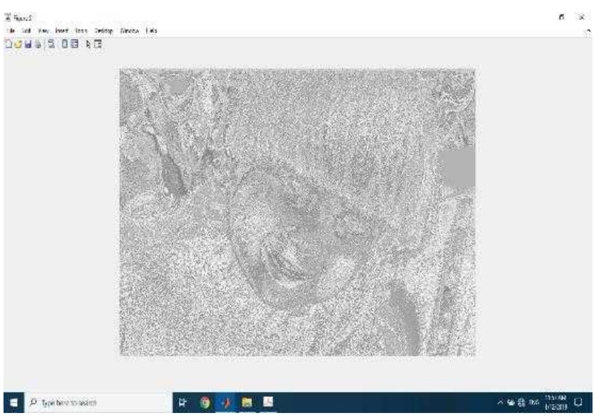


Figure: Orginal image

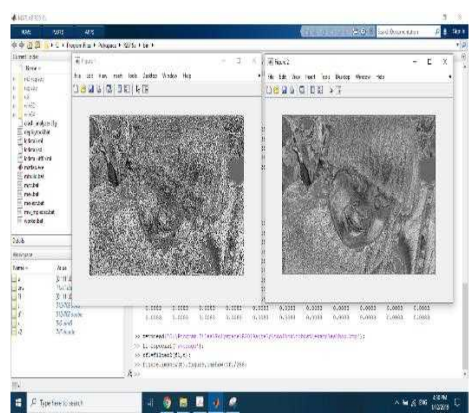


Figure: Averasing image

Frequencies; low and high pass filters: Fundamentally, the frequencies of an image are the amount by which grey values change with distance. high pass filter if it "passes over" the high frequency components, and reduces or eliminates low frequency components, low pass filter if it "passes over" the low frequency components, and reduces or eliminates high frequency components.

The images are shown in figure high pass filter. 1st Image is the result of the Laplacian filter; 2nd image shows the result of the Laplacian of Gaussian ("log") filter.

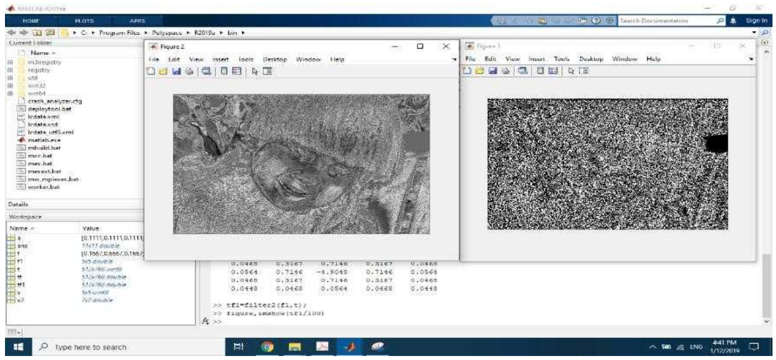


Figure: High pass filtering

We can generally obtain a better result by dividing the result of the filtering by a constant before displaying it. This is also shown in figure.

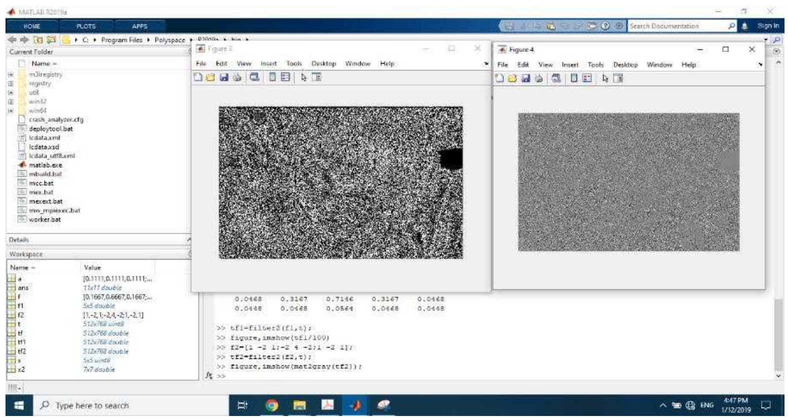


Figure: Using a high pass filter and displaying the result

Gaussian filters: Gaussian filters are a class of low-pass filters, all based on the Gaussian probability distribution function.

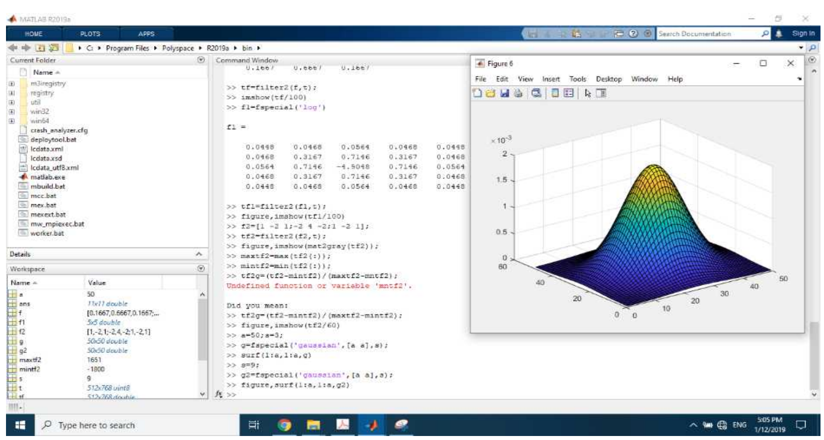


Figure:Two dimensional gaussians

4. Results and Discussion

4.1 Point Processing

A pixel's grey value is changed without any knowledge of its surrounds. Although point operations are the simplest, they contain some of the most powerful and widely used of all image processing operations. They are especially useful in image pre-processing, where an image is required to be modified before the main job is attempted. For point processing I have done many operations such as,

Arithmetic operations: These operations act by applying a simple function y= f(x). to each grey value in the image. Simple functions include adding or subtract or multiply and division a constant value to each pixel.

4.2 Complements

The complement of a greyscale image is its photographic negative. If an image matrix m is of type double and so its grey values are in the range 0.0 to 1.0, we can obtain its negative with the command.

4.3 Histograms

Given a greyscale image, its histogram consists of the histogram of its grey levels; that is, a graph indicating the number of times each grey level occurs in the image. as the following examples indicate:

- In a dark image, the grey levels (and hence the histogram) would be clustered at the lower end.
- In a uniformly bright image, the grey levels would be clustered at the upper end.

4.4 Histogram Stretching (Contrast Stretching)

Suppose we have an image with the histogram, associated with a table of the numbers (ni) of grey values.

4.5 Histogram Equalization

The trouble with any of the above methods of histogram stretching is that they require user input. Sometimes a better approach is provided by histogram equalization, which is an entirely automatic procedure. Notice the far greater spread of the histogram. This corresponds to the greater increase of contrast in the image.

4.6 Thresholding

Thresholding is a vital part of image segmentation, where we wish to isolate objects from the background. It is also an important component of robot vision. Thresholding can be done very simply in MATLAB. Suppose I have an 8 bit image, stored as the variable X. it has two types such as,

Single thresholding. b) Double thresholding

4.7 Spatial Filtering

I have seen in point processing that an image can be modified by applying a particular function to each pixel value. Spatial filtering may be considered as an extension of this, where I apply a function to a neighborhood of each pixel. The idea is to move a "mask": a rectangle (usually with sides of odd length) or other shape over the given image. As i do this, i create a new image whose pixels have grey values calculated from the grey values under the mask, The combination of mask and function is called a filter. I see that spatial filtering requires three steps:

- Position the mask over the current pixel,
- Form all products of filter elements with the corresponding elements of the neighborhood,
- Add up all the products.

In this project I have done some operation in spatial filter using MATLAB. Such as,

To apply this to an image, consider the 5 x 5"image" obtained by MATLAB. Function.

4.8 Notation

It is convenient to describe a linear filter simply in terms of the coefficients of all the grey values of pixels within the mask. This can be written as a matrix.

4.9 Filtering in MATLAB

The filter2 function does the job of linear filtering the result is a matrix of data type double. The parameter shape is optional, it describes the method for dealing with the edges. filter2(filter, image,'valid') applies the mask only to "inside" pixels. We can see that the result will always be smaller than the original. filter2(filter,image,'full') returns a result larger than the original image.

4.10 Frequencies; Low and High Pass filters

Fundamentally, the frequencies of an image are the amount by which grey values change with distance. high pass filter if it "passes over" the high frequency components, and reduces or eliminates low frequency components, low pass filter if it "passes over" the low frequency components, and reduces or eliminates high frequency components.

4.11 Gaussian Flters

Gaussian filters are a class of low-pass filters, all based on the Gaussian probability distribution function and has one dimensional gaussian, two dimensional gaussian.

5. Conclusion

The Image processing tool boxes i.e. "Corel Paint Shop Pro Photo X2", Adobe Photoshop 7.0 and MATLAB 2019 are state of art tool having very effective enhancement algorithms for cartridge case head stamp mark and bullet striation images. Digital image processing plays a vital role in enhancement of poor-quality images. Especially data obtained from Automated Image Acquisition Systems, which is in the digital form, can best be utilized with the help of digital image processing. Image enhancement is an important components of digital image Processing. Image enhancement techniques help in improving the visibility of any portion or feature of the image suppressing the information in other portions or features.

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