

# Automatic Ultra Sound Digital Image Processing

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## Abstract

Image enhancement is one of the most important and difficult techniques in image processing. Image enhancement is the process of improving the visual semblance of an image, or the representation for future automated image processing as a result of providing the correct transformation for this technique. The weak contrast and noise among images such as satellite images, medical images, aerial images, and real-life photographs without using clarity. One of the utmost significant stages in detecting and analyzing images in the medical field is image improvement techniques that work to enhance the excellence (clarity) of the images, therefore, it is essential to remove noise and improve contrast to enhance the quality of image. The present work represents a program for image improvement, several implementations denoted that the difference of a program can work as a similar job in the best, quicker way and without the want for extra user effort. the program deals with serious problems regularly such as noise or Image distortion due to any accident through the hardware of the ultrasound device, thereby many available enhancement programs such as image processing. This issue occurs because of carelessness, the other accident occurs as a result of a technical error in printing a document on printer devices that led to dark or light words, therefore, the present work deals with this issue by utilizing the threshold method and some arithmetic operations with further procedures like eliminating color, altering a color and the image background.

**Keywords:** Ultra Sound Liver Image, Automatic Digital Processing, CNN Detection Diseases

## 1- Introduction

Understanding the data that was extracted from the images generated by the imaging device is the main goal of the image-processing process to interpret and describe the data extracted. Image processing is the main goal of transforming images in the required manner, this technology permits users to gain text, image processing prints, and data saving to a disk in a diversity of formats. In other words, image processing is analyzing graphic information in the images and the process of neutralizing in practical life.

The digital image processing subject is one of the themes that have acquired attention, great and wide proceed, and it has applications expanded and verified. It is now deemed one of the most significant computer implementations prevalent and for utilize in different domains, not located to the processing of normal images (individual photography or other), but also the processing of images in the field of various sciences, such as the processing of medical images taken with the sonar device, perhaps the most important of which is the detection of cancer diseases, where it has become possible to diagnose through the computer using CNN technology or the detection of the disease type in radiographs all this derived the interest in digital image processing [1].

Despite the modernity and importance of these fields, a further field has been chosen that might seem traditionalist in its subject, but it is important in its application because it is concerned with an issue found in medical examinations with ultrasound devices in particular or because of other printing or imaging devices that require processing images with programs.

The purpose of the research is to be able to process digital images by using a Python program to achieve the functionality of image processing. The main reason is doing a Python program is that it is very flexible. It can be seen that the code grows somewhat more complicated when changing values based on calculations or moving pixels that consider all the values.

From the above technologies, all deep learning in the event of its application, the images must be processed before entering them into the system to obtain high results, and this is done from the application [2].

## 2- Related Work

The first technique details in reference [5], It shows the distribution of the input for the image as a signal, such as a photo or a video form, and the production is an image or attributes related with that image. The research treats images in overall while video as signals of two-dimensional that are then subjected to pre-programmed signal proceedings. It is one of the technologies that is developing quickly, in a wide range of field applications. There are sections on basic analysis and imaging methods, so, knowing the converting process of an image into a digital form, after which the image enhancement or data extraction processes related to image processing are carried out. The researchers relied on a method of the distribution of signal, where the image input is (such as medical images or video) and the production is an image attribute related to the image. The images are usually treated as signals of two-dimensional that are subject to techniques for signal processing by using programs of image processing. They consider the technologies of image processing one of the quicker developing applications. In industries of a wide range, both computer science and engineering, where this study is an important issue [5,6].

There are four stages of image processing configuration as follow up below:

- import the image by utilizing conquesting tools of picture
- Inspecting and amending the image
- The production of the image that may include a report or change based on image analysis.
- Brims detected is a method of weak level image processing.

Weak-level algorithms of image processing include:

- The brims detection
- Customer segmenting.
- Classifying;
- Detection of characteristics and matching

The researchers are using **Scikit-image** (**Scikit-image is a collection of algorithms for image processing**). The process of images in a wide range utilizing an uncomplicated interface that works fine for both images in 2D and 3D. It is fully combined addicted to the Scientific Python setting, it compatible with observation libraries and other data training tools, as shown in Figure (1):

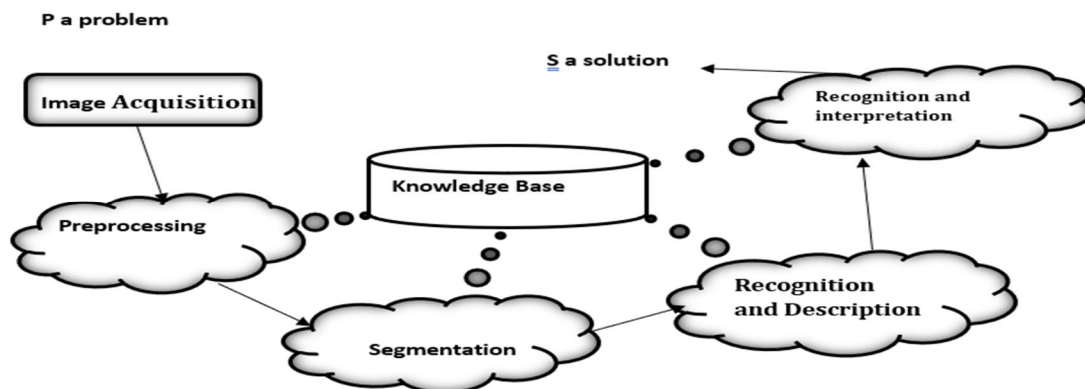


Figure (1) Image processing in action [5]

Where: -

- **Image acquisition:** In this step, images are processed while the image is digitized and captured by a sensor (color camera or monochrome) and the analog-digital device translates the production of the sensor element or camera, if it is not already in digital formatting [5,6].
- **Interpretation and recognition:** confession is the process of an element label, for the information provided by its characteristics, while interpretation is the distribution that aims to link the recognized objects [5,6]
- **Segmentation:** several methods for dividing an image into parts, where the image is divided into segments and called segmentation through the information in [5,6]
- **Outline and Representation: Through outline and representation, data is converted into a suitable format for processing [5,6]**
- **Information domain:** The cloud domain describes the image regions where the cognitive content is mapped and which helps in narrowing the scope of the search.
- **Edge Detection:** Lines indicate value changes such as plane intersections and plane cross-sections, lines, textures, and colors, as well as texture and shading adjustments [5,6]
- **Image compression:** The presence of large data in electronic images in large amounts necessitates data use transmission through the networks susceptible to management this amount of data used. Provided by the resolution and temporal of the image number per second, and therefore the range of gray levels of the image quality will appear.
- **Real-time image processing:** The techniques are proposed with two different real-time processing [5,6].

The next technique details in reference [8], The researchers based this research and analysis on the PIL library where the software performs filtering technology of image, image contour details, edge enhancement of image, and other image processing in the Python platform, as exhibit in Figure (2), and analyzed the effects many different images.

Using the PIL library and the save and open functions, it converts between JPG, PNG, and BMP format of images so that the image enhancement module is utilized to achieve contrast change of images. Through the technique for splitting and merging the separation and merging channel to alteration the color of the present image, in addition that using the filters for the images.

in digital image processing Python programs can be applied in several aspects, and can view that Python greatly improves the digital image processing quality faster, suitability, and without missing verification of the basic theory [8]

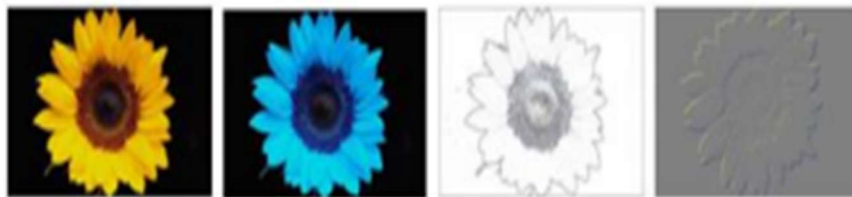


Figure [2] Comparison of several different images [8]

The last technique details in reference [9] Where ordinary images are processed through algorithms, which are a basic building block in many areas of logical research, algorithmic examinations, information investigation in relation to reproducible sciences, and to demonstrate instructions in preparing images in the form of scikit-image as shown in figure (3).

The main goal for any researcher to get started quickly with scikit-image is to make it easier, particularly researchers in a programming language like Python. Note that the base image is nothing but a standard NumPy array, which displays pixel information directly, so a new researcher loading image from disk (or use sample of one the images files from scikit-image) and quickly display the results process of that image using one or more image filters.

For example, to split the introduction and the basis of the image edge to make a binary image. Only a few accounts of edge images can be accessed. Here, the use of the versatile filter. The threshold of the estimated image is the weighted average of the pixel that be neighborhood.



Figure (3). Illustration of several functions available in scikitimage: adaptive threshold [9]

### 3- Digital Image

It consists of several elements, each of which has a particular location and values called elements. Pixels or image elements is known images can play an significant role in the writing of data, but the human conception of images is limited to those images that were determined in the visible range of the whole spectrum of electromagnetic , from gamma rays to radio waves, such as images taken with ultrasound examination devices, calculators, electron microscopy and others.

Any image can be mathematically defined as two-dimensional function  $(x, y)$ . The coordinates of the 2 D and point represent the intensity or gray level at that point, the digital images are gained from devices of digital imaging, where the  $(x, y)$  values and 2 D belong to a specific values set and are easy to process by this field and the digital computer is named digital image processing [10]

Therefore, possibly dividing the procedures achieved into three levels on digital images by using the computer:

- 1- weak-level operations that include removing distortion, increasing image sharpness, noise reduction, improving contrast, and operations of edge detection, which are concerned with image processing at a pixel level, and this process can be designated as those operations that have an input and output of images.
- 2- Intermediate -level processes that uses the data take out from the weak level, which contains separating the image into elements or areas and describing the elements to decrease them of a valid representation for processing by the calculator. Intermediate level processes can be designated as processes whose input data and output data are characterize, and features derived from the image data, for example, the frames of the identity of elements and elements.
- 3- High-level processes, that take out beneficial information from the prior two levels, which are applications of processing such as line confession, for example, and the understanding process or perceiving an element set that have been recognized, and at the upper of the processes of level derives from the learning procedures and the acquisition of information related with the view of the calculator.

### 4- Digital Image Processing

The importance of digital image processing lies in several areas, the most important of which are: -

1. Enhancing illustrated data to simplify its clarification and most importantly humans for understanding.
2. Image processing data for the determinations of storing on different media, sending the images from one place to one more with the lowermost possible bandwidth.
3. Automatic perception of digital inside image processing program of the image contents without human assistance.
4. Image processing to make it suitable for applications.

In a deep learning has great impact on several fields of technology in a few past years. Among the most important interesting themes in the industry is the computer vision, which is the ability of computers to understand videos and images on its own. The essence of the computer's vision is images processing. [12,13]

## **5- TYPES of IMAGE PROCESSING**

Before we move to image processing, we first need to understand what the image is exactly. The image is denoted in its sizes (width and height) based on the numeral pixels. For example, if the sizes of the image are 400 x 500 (height x width), the total amount of pixels is 200,000. for the image

This pixel is a point in the image that earnings a shadow, out of a specific color, or a specific color [12,13]

It is usually denoted in one of the subsequent procedures:

- Gray-gradient-pixel is a correct number of 0 to 255 (0 is black and 255 is white).
- RGB - Pixels consist of 3 correct numbers ranging from 0 to 255 (the correct numbers are the red intensity, green, and blue).
- RGBA- It is an expansibility of the RGB by the addition of the alpha field, which denotes the image to the image.

Photo processing needs fixed arrangements of processes that are carried out to each pixel of the image. The photo mainframe carries out the first arrangement of processes on the image, pixel after another. Once is completely completed, the second process will begin, and so on. The resulting value of these processes may be calculated at a little pixel of the image, and the images processing is the procedure of converting the image into a digital model and performance certain processes to obtain some beneficial data from it. The image processing system generally deals with all images as two-dimensional signals when implementing confident ways to process pre -defined signals. [12]

### **5-a: IMAGE TYPES [12]**

Therefore, the image processing has five main sorts:

1. Visualization - Find objects that aren't observable in the image
2. Re-confession – Find out or distinguish objects in the image
3. Restoration and sharpening - Generate an improved image from the original image
4. Recognition of pattern - Measure the several patterns from one place to another of the objects in the image
5. Recover - Search images and browse from a great database of digital images that are like to the original image.

### **5-b: Image Processing advantage [12]**

The application of image processing techniques has a huge influence on several tech system of government. Here, some of the greatest useful assistances of image processing, nonetheless of the operation field:

1. The digital image may be made obtainable in any favorite format (X-Ray, enhanced image, photo negative, etc.).
2. It aids to enhance images for human explanation.
3. Information may be extracted and administered from images for machine explanation.
4. The pixels in the image may be operated to any wanted contrast and density.
5. Images may be retrieved and stored easily.
6. It permits for easy electronic transmission of images to third-party earners.

## 6- image processing Technics

### 6-a: Morphological Image Processing

Trying morphological images trying to remove defects from bilateral images because the bilateral areas constructed by easy thresholds can be deformed due to noise. It also aids in softening the image utilizing opening and closing processes.

Morals may be expanded to include gradient images. It involves of non -written processes associated to the image features structure. This depends on the arrangement associated with pixel units, but depend on their digital amounts. The technique of analyze the image utilizing a small model recognized as the element of structure, where is placed on diverse potential sites in the image and compares it by the opposite adjacent pixel units. The element of structure is a small matrix of two binary values 0 and 1.

The stretching process enhances pixels to the object boundaries, while the deformation of the image leads to removal of pixels units from the item border.

The number of pixels removed or added to the original image depends on the size of the structure. [6]

The element of structure is a matrix containing only binary values 0 and 1 which may have any form and random dimensions. It is placed in all conceivable places in the image and comparison with the opposite pixel units.

### 6-b: Gaussian Image Processing

Al -Gaussian camouflage, also known as the Al -Gaussian homogeneity, is the result of the disturbance of the image with a galaxy function.

It is utilized to decrease the disturbance of the image and decrease the specifics. The visible effects of the camouflage technique are like to this view of the image throughout the transparent screen. It is occasionally utilized to see the computer to improve the image at diverse levels or as a technique to increase information in profound learning.

Practically, it is better to gain benefit of the semester clutch properties by separating the procedure into double tracks. In the first permit, a single -dimensional nucleus is utilized to blur the image in the horizontal or vertical direction only. In the second permit, the similar single -dimensional nucleus is utilized to blur in the residual direction. The resultant outcome is the similar effect caused by wrapping with the two -dimensional nucleus in one path. [6,11]

Then can see that approximately edges have a tiny fewer detail. The candidate gives a greater mass to the pixels in the middle compared to the pixels away from the center. Gaussian filters are low pass filters, that is, high frequencies weaken. It is usually used to detect the edge.

The basic gaussian function looks like:

$$G(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{\sigma^2}{2\sigma^2}}$$

### 6-c: Fourier Transform in image processing

Breaks down of Fourier transform an image into sine and cosine wave components.

It has several requests like image rebuilding, image filtering, and image compression. So, the talking about images take distinct Fourier transform into consideration [6,11].

Let's study a sinusoid, it includes of three things:

Magnitude – associated to dissimilarity

Spatial frequency – associated to brightness

Phase – associated to color data

The image in the frequency field look

The method for 2D distinct Fourier transform is:

$$F(u, v) = \frac{1}{MN} \sum_{X=0}^{M-1} \sum_{Y=0}^{N-1} f(X, Y) e^{-j2\pi(\frac{uX}{M} + \frac{vY}{N})}$$

### 6-d: Edge Detection in image processing

The discovery of edges is a picture processing technique to find the borders of the items inside the images. It works by noticing interruptions in illumination.

This may be very useful in take-out beneficial data from the image because utmost of the form data is surrounded by the edges. The methods of detecting classic edges work by discovering interruptions in brightness. [6,11], It can react quickly if some jamming in the image is discovered while the differences in gray color levels are discovered. The edges are defined as the local maximum gradient.

Resultant gradient may be computed as:

$$G = \text{sqrt}(G_x^2 + G_y^2)$$

### 6-e: Image Processing of Wavelet

Wavelets take both time and frequency into consideration, then can be seen Fourier transform but only limited to the frequency. Where This transform is apt for non-stationary signals.

The wavelet transform is designed in such a way that we get good frequency resolution for weak-frequency components. the edges are one of the important parts of the image, while applying the traditional filters it's been noticed that noise gets removed but the image gets blurry. [6,11]

### Proposed Algorithm for Automatic Digital Ultra Sound Image Processing

Due to the readability, simplicity, and extensibility of the Python language program, scientific computing of several open source software packages makes available Python communication interfaces, such as the OpenCV computer visible library, the VTK 3D conception library, and the ITK medical image procedure library. Python has further particular scientific calculating extra time libraries, thus, the Python advance environment and several extension libraries are very appropriate. With the aid of scientific researchers and engineering technology, we can process experimental data, create graphs, and even develop scientific calculating requests [10].

As shown in the algorithm below, through code which all images taken with the ultrasound examination device are processed, the first step is to call the most important library in image (JPG) processing, which is CV2 (computer vision library).

As for steps 7-9, the image folder is import from it during loading the storage location. In steps 12-14, the images are stored in another folder within the program called (Path + Image Filter).

Steps 18-20 in which a new folder called (desfolder) is created for the purpose of storing the processed images. We notice in steps 24-28 that all images and documents that are not of the (JPG) type are excluded and only the required images (JPG) are kept, even if this type image does not exist. From the image, the phrase (the folder is empty) is sent in step 28.

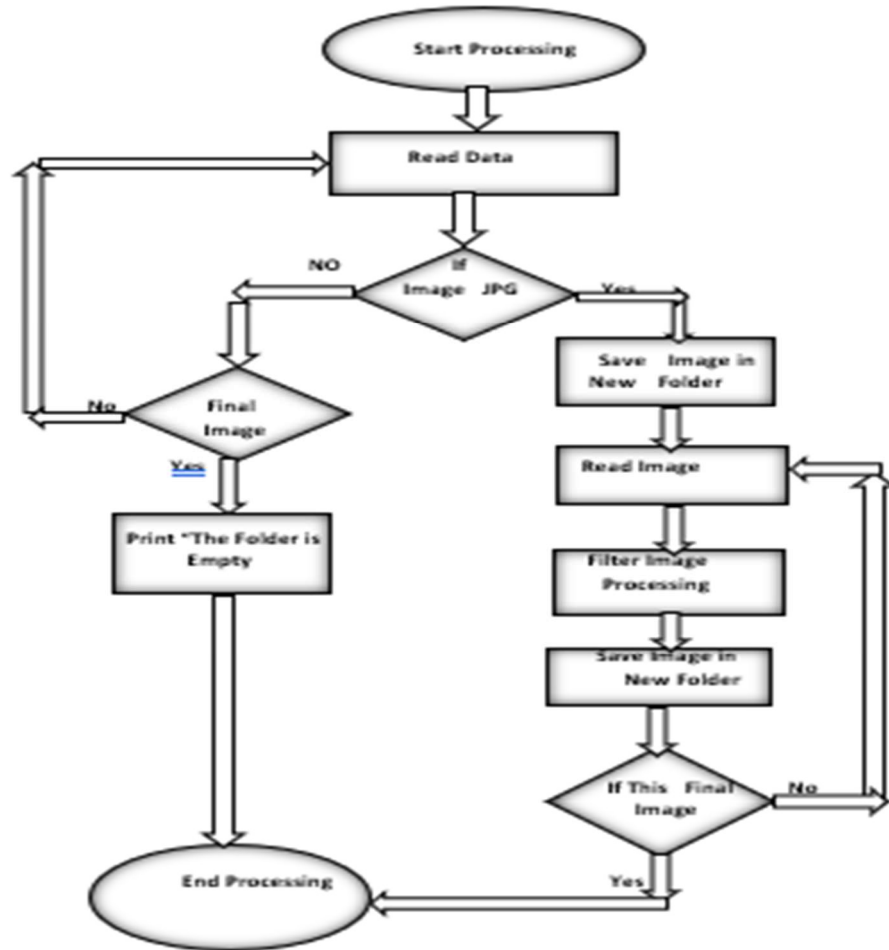
Through steps 34-39, a loop is created for the purpose of examining the images stored in the folder (Image Folder), one by one, until the last (JPG) image is reached, even if its number is 1000. In step 39, the first image is import.

In steps 42-43, the images are processed by deleting the frame and measurements around the image that cause errors in the required results and storing them in a folder called (Temp-Image). As for the accidental lines that may exist inside the image, they are erased in steps 46-47, after which they are stored. All images were processed in the folder (desfolder), which was created previously.

At the end of the program, the phrase "finished" is sent in steps 57-58, and the result of the program can be seen in Figure (4).

## Algorithm

All the process for image processing will be describe in the algorithm below



## Code

```

import os, fnmatch, cv2, sys
# Making sure the folder path is provided to the program
# and showing the method to us it
if len(sys.argv) < 2:
    print("Usage: filter.exe [Folder_path]")
    sys.exit(0)
# Getting the provided folder path from the system
path = sys.argv[1]
desFolder = path + '\\Filtered images'

# Create a folder for saving the filterd images
if not os.path.isdir(desFolder):
    os.mkdir(desFolder)
# search the folder for JPG image file format
# Gives a message if the folder doesn't contain a the right file format
imgFiles = fnmatch.filter(os.listdir(path), "*.JPG")
if len(imgFiles) < 1:

```



```

print("The folder is empty, or doesn't contain JPG images")
# Looping through the images files one by one
for i in range(len(imgFiles)):
    # make sure the right directory of the original images
    os.chdir(path)
    # Load the image
    img = cv2.imread(imgFiles[i])
    # Take the important part of the original image and save it in a temporary file
    temp_img = img[200:823, 200:1050]
    # using a filled black rectangle shape to eliminate the any extra unwanted features
    new_img = cv2.rectangle(temp_img,(726,552),(850,620),(0,0,0),-1)
    # save the new image in the newly created folder
    os.chdir(desFolder)
    cv2.imwrite(files[i],new_img)
# Send an ending message
print("Finished!!!!!!"
)

```



(a)

Image before processing



(b)

image after processing

Figure (4): image processing

## 7- Conclusion

We conclude from all of the above that all research applied the program to a single image, and then each image was entered in a separate format to obtain the best results through the filters required in the specific research. As for this research, in the above, the algorithm was designed in the Python language, and a group can be entered from the image through it. Their number at a time may reach 1000 or more, and they are processed by the system successively and at a very high speed, and this is what we see clearly in Figure (4), which represents an image that has been improved through the algorithm above, where it can then be entered into the CNN technology application.

Applying the digital image enhancement method has proven to be very successful in applying programs that use digital images, especially CNN technology, which relies entirely on image clarity. The higher the resolution of the image, the better the results and can be adopted in practical application. Whenever the image is unclear (distortion), this leads to inaccurate results and therefore cannot be applied in practice because it leads to wrong results.

Therefore, we improved the images of the liver taken from the ultrasound device for the purpose of using it in the program for early detection of liver diseases in the Python language using CNN technology, so that the results are correct and intended.

## **ACKNOWLEDGMENTS**

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