



## Scrutiny on Image Processing

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**Abstract-** Image processing is often viewed as arbitrarily manipulating an image to achieve an aesthetic standard or to support a preferred reality. However, image processing is more accurately defined as a means of translation between the human visual system and digital imaging devices. The human visual system does not perceive the world in the same manner as digital detectors, with display devices imposing additional noise and bandwidth restrictions. Image processing must be approached in a manner consistent with the scientific method so that others may reproduce, and validate, one's results. This includes recording and reporting processing actions and applying similar treatments to adequate control images.

**Keywords:** Data Compression, Image Processing, Image Enhancement, Image Restoration, Image Recognition.

### I. INTRODUCTION

Image processing is the study of any algorithm that takes an image as input and returns an image as output which includes:

- 1) Image display and printing
- 2) Image editing and manipulation
- 3) Image enhancement
- 4) Feature detection
- 5) Image compression

Image Processing is a technique to enhance raw images received from cameras/sensors placed on satellites, space probes and aircrafts or pictures taken in normal day-to-day life for various applications.

Various techniques have been developed in Image Processing during the last four to five decades. Most of the techniques are developed for enhancing images obtained from unmanned spacecrafts, space. Image Processing systems are becoming popular due to easy availability of powerful personnel computers, large size memory devices, graphics software's etc. Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them. It is among rapidly growing technologies today, with its applications in various aspects of a business. Image Processing forms core research area within engineering and computer science disciplines too.

Image processing basically includes the following three steps.

- 1) Importing the image with optical scanner or by digital photography.
- 2) Analyzing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs.
- 3) Output is the last stage in which result can be altered image or report that is based on image analysis.

The schematic diagram of image scanner-digitizer diagram is shown in figure 1.

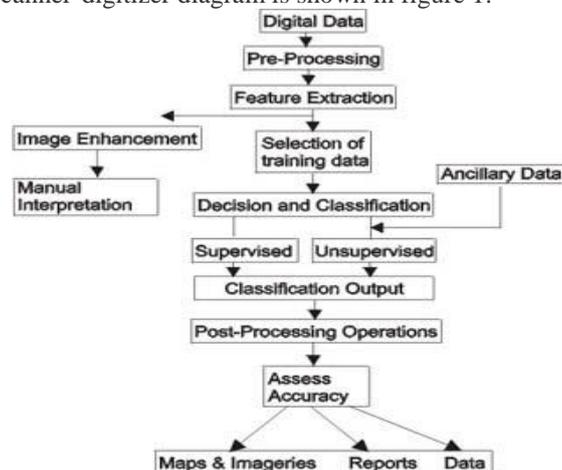


Figure.1: Schematic diagram of image scanner-digitizer

## II. TYPES

The two types of methods used for Image Processing

### A. Analog Image processing

### B. Digital Image processing

Analog or visual techniques of 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. The image processing is not just confined to area that has to be studied but on knowledge of analyst. Association is another important tool in image processing through visual techniques. So analysts apply a combination of personal knowledge and collateral data to image processing.

Digital Processing techniques help in manipulation of the digital images by using computers. As raw data from imaging sensors from satellite platform contains deficiencies. To get over such flaws and to get originality of information, it has to undergo various phases of processing. The three general phases that all types of data have to undergo while using digital technique are Pre- processing, enhancement and display, information extraction.

## III. SIMPLE IMAGE PROCESSING OPERATIONS

### A. Image Enhancement:

Image enhancement improves the perceptibility of the image by modifying the brightness differences between the image and its background and suitably modifying other characteristics. To depict image enhancement a simple image is taken (Figure 2) .

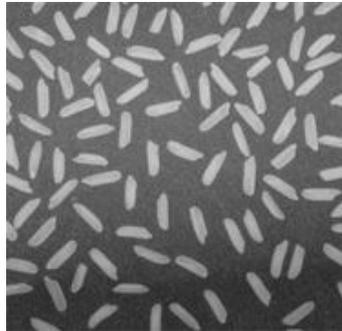


Figure. 2 Unclear image before Enhancement

As the image is quiet sharp and not clear hence the pixel values of the image is flipped over to obtain a better image. Comparing Figure 2 and Figure 3 we can easily see the flipped over pixel values.



Figure3. Improved image after Enhancement

### B. Noise Removal:

Digital Images are prone to variety of noise that tends to change the true intensities of the pixel values in the image. With the help of using filters in the image processing schemes a noisy image can be de-noised. Figure 5 shows a grey image free from any sort of noise.



Figure .5 Original image without noise introduction

In Figure 6 noise is deliberately added to the image of Figure 5. The resulting figure thus seems blurred. This noise can be removed with the help of a filter.



Figure .6 Addition of noise to the image of Figure 5.



Figure.7 Image after removal of noise of Figure 6.

**C. Image Restoration:**

Image Restoration is the technique of making small modifications to the images. Applications of image restoration range from the removal of an object from a scene to the retouching of a damaged image. Also, the restoration technique can be used to remove deterioration, e.g. a crack in an image or remove and add an element to the image. In each case, the goal is to produce a modified image in which the restored region is merged into the image so seamlessly that a typical viewer is not aware that any modification has occurred. To illustrate this two images are taken.



Figure. 8 Image with distortion in it



Figure. 9 Image after the effects of restoration

The first image i.e. Figure 8 is the image with small amounts of deterioration in it. However after applying the image restoration techniques, the deteriorated image is improved as shown in Figure 9.

**D. Edge Detection:**

Edge Detection identifies object boundaries within images. It works by detecting the discontinuity in the brightness level in the image. Edge detection techniques are used for image segmentation and data extraction in areas such as computer vision, etc. The algorithm used here for edge detection is the ‘Canny Edge Detector’ algorithm. In this algorithm technique the image is filtered with the derivative of Gaussian. Then the magnitude and orientation is calculated. Two threshold levels are then defined: low and high. The high threshold level is used to start the edge curves while the low threshold level is to continue them.

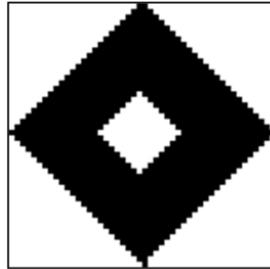


Figure.10 A normal image

Here also image in Figure 15 is the simple image showing whereas the image in Figure 16 is the image with the edges detected after applying the Canny Edge Detection scheme.

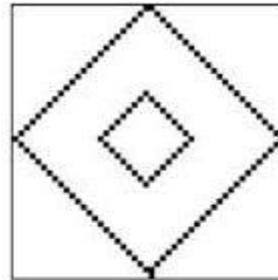


Figure.11 Detection of edges of Figure 10.

**E. Image Compression:**

Image Compression is the technique of reducing or elimination of the redundant or irrelevant information from the image. It is one of the most important techniques used image processing. Image compression is almost used everywhere while processing images. For example the image sent by mars rover to the NASA space station is very heavy and large in size. To process the information from the image first it has to be compressed and thus image compression finds its applications. Figure 12 shows an image which is 77.9 KB in size but after compression it reduces to 19.11 KB shown in Figure 13.



Figure.12 An uncompressed image (77.9 KB)



Figure.13 An compressed image (19.11 KB)

#### IV. PURPOSE OF IMAGE PROCESSING

The purpose of image processing is divided into five groups. They are:

- A. **Visualization** - Observe the objects that are not visible.
- B. **Image sharpening and restoration** - To create a better image.
- C. **Image retrieval** - Seek for the image of interest.
- D. **Measurement of pattern** – Measures various objects in an image.
- E. **Image Recognition** – Distinguish the objects in an image.

#### V. APPLICATION

**A. Intelligent Transportation Systems**– This technique can be used in Automatic number plate recognition and Traffic sign recognition.

**B. Remote Sensing**– For this application, sensors capture the pictures of the earth's surface in remote sensing satellites or multi – spectral scanner which is mounted on an aircraft. These pictures are processed by transmitting it to the Earth station. Techniques used to interpret the objects and regions are used in flood control, city planning, resource mobilization, agricultural production monitoring, etc.

**C. Moving object tracking**– This application enables to measure motion parameters and acquire visual record of the moving object. The different types of approach to track an object are:

- 1) Motion based tracking
- 2) Recognition based tracking

**D. Defence surveillance**– Aerial surveillance methods are used to continuously keep an eye on the land and oceans. This application is also used to locate the types and formation of naval vessels of the ocean surface. The important duty is to divide the various objects present in the water body part of the image. The different parameters such as length, breadth, area, perimeter, compactness are set up to classify each of divided objects. It is important to recognize the distribution of these objects in different directions that are east, west, north, south, northeast, northwest, southeast and south west to explain all possible formations of the vessels. We can interpret the entire oceanic scenario from the spatial distribution of these objects.

**E. Biomedical Imaging techniques**– For medical diagnosis, different types of imaging tools such as X- ray, Ultrasound, computer aided tomography (CT) etc are used.

Some of the applications of Biomedical imaging applications are as follows:

- 1) Heart disease identification
- 2) Lung disease identification
- 3) Digital mammograms.

**F. Automatic Visual Inspection System**– This application improves the quality and productivity of the product in the industries.

#### VI. FUTURE SCOPE

The future of image processing will involve scanning the heavens for other intelligent life out in space. Also new intelligent, digital species created entirely by research scientists in various nations of the world will include advances in image processing applications. Due to advances in image processing and related technologies there will be millions and millions of robots in the world in a few decades time, transforming the way the world is managed. Advances in image processing and artificial intelligence will involve spoken commands, anticipating the information requirements of governments, translating languages, recognizing and tracking people and things, diagnosing medical conditions, performing surgery, reprogramming defects in human DNA, and automatic driving all forms of transport. With increasing power and sophistication of modern computing, the concept of computation can go beyond the present limits and in future, image processing technology will advance and the visual system of man can be replicated. The future trend in remote sensing will be towards improved sensors that record the same scene in many spectral channels. Graphics data is becoming increasingly important in image processing applications.

#### VII. CONCLUSION

We all are in midst of revolution ignited by fast development in computer technology and imaging. Against common belief, computers are not able to match humans in calculation related to image processing and analysis. But with increasing sophistication and power of the modern computing, computation will go beyond conventional, Von Neumann sequential architecture and would contemplate the optical execution too. Parallel and distributed computing paradigms are anticipated to improve responses for the image processing results.

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