Extensive Study On Image Processing

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Abstract- *Image processing is the use of certain process to perform image processing on images. As a category or field of signal processing, Digital Image processing has many advantages over analog image processing which in turn has many Advantages over Optical Image Processing .It allows a much wider range of procedures to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are two dimensional (perhaps more) digital image processing may be modeled in the form of multidimensional systems.*

Keywords- Image Processing, Digital Image Processing , Analog Image Processing

I. HISTORY

Many of the techniques of Image processing, or digital picture processing as it often is called, were developed in the 1960s at the Jet Propulsion Laboratory, Massachusetts Institute of Technology, Bell Laboratories, University of Maryland, and a few other research facilities, with application to satellite imagery, wire-photo standards conversion, medical imaging, videophone, character recognition, and photograph enhancement.[1] The cost of processing was fairly high, however, with the computing equipment of that era. That changed in the 1970s, when digital image processing proliferated as cheaper computers and dedicated hardware became available. Images then could be processed in real time, for some dedicated problems such as television standards conversion. As general-purpose computers became faster, they started to take over the role of dedicated hardware for all but the most specialized and computer-intensive operations. With the fast computers and signal processors available in the 2000s, digital image processing has become the most common form of image processing and generally, is used because it is not only the most versatile method, but also the cheapest.
Digital image processing technology for medical applications was inducted into the Space Foundation Space Technology Hall of Fame in 1994

II. WHAT IS IMAGE PROCESSING

Image processing is a method to convert any image into a valid input format and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. 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-

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

III. NEED FOR IMAGE PROCESSING

The purpose of image processing is divided into 5 groups. They are:

1. Visualization - Observe the objects that are not visible.
2. Image sharpening and restoration - To create a better image.
3. Image retrieval - Seek for the image of interest.
4. Measurement of pattern – Measures various objects in an image.
5. Image Recognition – Distinguish the objects in an image.

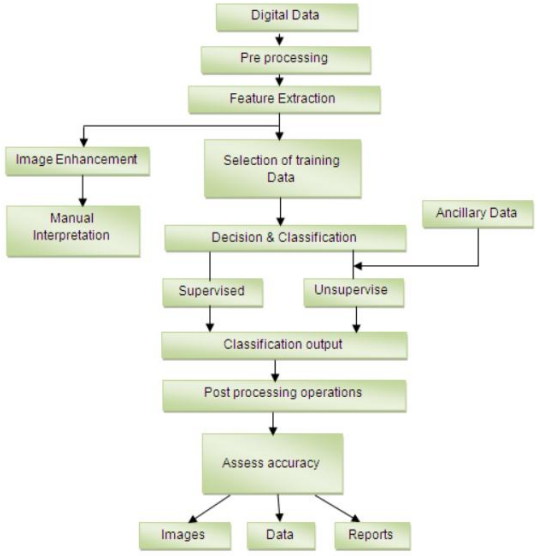
IV. TYPES OF IMAGE PROCESSING

- Analog Image Processing
- Digital Image Processing
- Optical Image Processing

The two types of methods used for Image Processing are Analog and 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.



V. APPLICATIONS OF IMAGE PROCESSING

1. Computer Vision-Computer vision is a branch of science and technology of machines that see. As a scientific discipline, computer vision is concerned with the theory for building artificial systems that obtain information from input images. The image data can take many forms, such as a video sequence, views from multiple cameras, or multi-dimensional data from a medical scanner.As a technological discipline, computer vision seeks to apply the theories and models of computer vision to the construction of computer vision systems. Computer vision can also be described as a complement (but not necessarily the opposite) of biological vision. In biological vision, the visual perception of humans and various animals are studied, resulting in models of how these systems operate in terms of physiological processes. Computer vision, on the other hand, studies and describes artificial vision system that are implemented in software and/or hardware. Interdisciplinary exchange between biological and computer vision has proven increasingly fruitful for both fields.

2. Face Detection- Face detection is a computer technology that determines the locations and sizes of human faces in arbitrary (digital) images. It detects facial features and ignores anything else, such as buildings, trees and bodies. Face detection can be regarded as a specific case of object-class detection; In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class. Face detection can be regarded as a more general case of face localization; In face localization, the task is to find the locations and sizes of a known number of faces (usually one). In face detection, one does not have this additional information. Examples include upper torsos, pedestrians, and cars. Face detection is used in biometrics, often as a part of (or together with) a facial recognition system. It is also used in video surveillance, human computer interface and image database management. Some recentdigital cameras use face detection for autofocus[1]. Also, face detection is useful for selecting regions of interest in photo slideshows that use a pan-and-scale Ken Burns effect.

3. Remote Sensing-Remote sensing is the small or large-scale acquisition of information of an object or phenomenon, by the use of either recording or real-time sensing device(s) that is not in physical or intimate contact with the object (such as by way of aircraft, spacecraft, satellite, buoy, or ship). In practice, remote sensing is the stand-off collection through the use of a variety of devices for gathering information on a given object or area. Thus, Earth observation orweather satellite collection platforms, ocean and atmospheric observing weather buoy platforms, monitoring of a pregnancy via ultrasound, Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), and space probes are all examples of remote sensing. In modern usage, the term generally refers to the use of imaging sensor technologies including but not limited to the use of instruments aboard aircraft and spacecraft, and is distinct from other imaging-related fields such as medical imaging.

4. Medical Imaging-Medical imaging refers to the techniques and processes used to create images of the human body (or parts thereof) for clinical purposes (medical procedures seeking to reveal, diagnose or examine disease) or medical science (including the study

of normal anatomy and physiology).As a discipline and in its widest sense, it is part of biological imaging and incorporates radiology (in the wider sense), radiological sciences, endoscopy, (medical) thermography, medical photography and microscopy (e.g. for human pathological investigations). Medical imaging is often perceived to designate the set of techniques that noninvasively produce images of the internal aspect of the body. In this restricted sense, medical imaging can be seen as the solution of mathematical inverse problems. This means that cause (the properties of living tissue) is inferred from effect (the observed signal). In the case of ultrasonography the probe consists of ultrasonic pressure waves and echoes inside the tissue show the internal structure. In the case of projection radiography, the probe is X-ray radiation which is absorbed at different rates in different tissue types such as bone, muscle and fat.

5. Microscope image processing-Microscope image processing is a broad term that covers the use of digital image processing techniques to process, analyze and present images obtained from a microscope. Such processing is now commonplace in a number of diverse fields such as medicine, biological research, cancer research, drug testing, metallurgy, etc. A number of manufacturers of microscopes now specifically design in features that allow the microscopes to interface to an image processing system. Until the early 1990s, most image acquisition in video microscopy applications was typically done with an analog video camera, often simply closed circuit TV cameras. While this required the use of a frame grabber to digitize the images, video cameras provided images at full video frame rate (25-30 frames per second) allowing live video recording and processing. While the advent of solid state detectors yielded several advantages, the real-time video camera was actually superior in many respects.

6. Lane departure warning system-In road-transport terminology, a lane departure warning system is a mechanism designed to warn a driver when the vehicle begins to move out of its lane (unless a turn signal is on in that direction) on freeways and arterial roads.The first production lane departure warning system in Europe was the system developed by Iteris for Mercedes Actros commercial trucks. The system debuted in 2000 and is now available on most trucks sold in Europe. In 2002, the Iteris system became available on Freightliner Trucks' trucks in North America. In all of these systems, the driver is warned of unintentional lane departures by an audible rumble strip sound generated on the side of the vehicle drifting out of the lane. If a turn signal is used, no warnings are generated.

7. Mathematical morphology-Mathematical morphology (MM) is a theory and technique for the analysis and processing of geometrical structures, based on set theory, lattice theory, topology, and random functions. MM is most commonly applied to digital images, but it can be employed as well on graphs, surface meshes, solids, and many other spatial structures. Topological and geometrical continuous-space concepts such as size, shape, convexity, connectivity, and geodesic distance, can be characterized by MM on both continuous and discrete spaces. MM is also the foundation of morphological image processing, which consists of a set of operators that transform images according to the above characterizations. MM was originally developed for binary images, and was later extended to grayscale functions and images. The subsequent generalization to complete lattices is widely accepted today as MM's theoretical foundation.

8. Here we are using a very simple image to show how digital processing can be used to change the image contrast.

As we see, the image consist of a background area and a small square object in the center. In the low contrast image on the left the background area has pixel values of 40 and the object in the center has pixel values of 30. The numerical contrast (the object relative to the back ground) is the difference (40-30=10).

Look up tables (LUT) are data stored in the computer that is used to substitute new values for each pixel during the processing.

In our example here, we are keeping it simple and working an image with only two pixel values, 40 and 30.

As we see here, the processing uses a LUT that substitutes a 90 for a 40 and a 10 for a 30. The effect of this is to increase the image contrast (90-10=80).

As we are about to discover, it is usually possible for the user to select from a variety of LUTs, each one designed to produce specific contrast characteristics.

9. Let's recall that a LUT indicates what number is to be substituted for each pixel value during the processing of the image.

It is very helpful to show this relationship between the original pixel values and the new values with a graph as we see here.

Here we are starting with a simple straight-line or linear graph that shows that the substituted number is the same as the original image pixel value.

Processing with this LUT does not change the image, it just introduces us to the concept of LUTs.

10. The Blurred Mask Subtraction is often used, especially in digital radiography, to enhance the visibility of detail in certain clinical procedures.

Important point....This process does not un-blur an image and recover detail that was completely lost because of blurring from the focal spot, motion, and the receptor. What it does do is increase the visibility (contrast) of some objects, especially where the visibility of the objects is somewhat limited by large area contrast as in chest imaging.

The process consist of two distinct steps. First, a blurred copy of the original image is produced. A common form of digital processing that can be used to produce a blurred image is just by replacing each pixel value with the average of the pixel values in it's neighborhood. This produces a "blurred mask" image.

The blurring removes all detail from the image (that is what blurring does!). We now have two images. The original image contains the general large-area contrast background plus some detail. The blurred mask image contains only the large-area contrast background
The final step is where the computer subtracts the blurred mask image (actually some fraction of it) from the original image.

This process reduces the large-area contrast background in relation to the contrast of the detail. The result is that the contrast and visibility of the detail (small objects and structures) in enhanced.

11. Defense surveillance - Application of image processing techniques in defense surveillance is an important area of study. There is a continuous need for monitoring the land and oceans using aerial surveillance techniques. Suppose we are interested in locating the types and formation of naval vessels in an aerial image of ocean surface. The primary task here is to segment different objects in the water body part of the image. After extracting the segments, the parameters like area,location, perimeter, compactness, shape, length, breadth,and aspect ratio are found, to classify each of the segmented objects. These objects may range from small boats to massive naval ships. Using the above features it is possible to recognize and localize these objects. To describe all possible formations of the vessels, it is required that we should be able to identify the distribution of these objects in the eight possible directions, namely, north, south, east, west, northeast, northwest, southeast and southwest. From the spatial distribution of these objects it is possible to interpret the entire oceanic scene, which is important for ocean surveillance.

VI. ADVANTAGES

This one is more accurate than the overlapping method because it is based upon minutia.

One of the major advantages in having medical images in digital form is the ability to perform a variety of processing procedures with a computer.

These procedures can be selected and adjusted to change the characteristics of the images, usually for the purpose of improving quality or optimizing characteristics for maximum visibility.

In this module we consider several of the processing methods, especially those that apply to digital radiography.

It is an interactive method for recognizing fingerprints.

Google Search Algorithm for Images:- Google Search algorithm has been totally changed. Now Google can read the images better ways and display the quality result in their search engine. Google can able to find and read the images/photos and display similar category image result online. So its good for having Digital Images processed by an expert for quality and get found in Google search. Having Digital Image can increased accuracy, higher speed.

Flexible Formats:- As per the requirement, Image can be made available in any desired formats.

Important in Online e-commerce Word:- Digital Images provide visual results that you may or may not want to show. So it directly talks to people and makes an impact on the people’s mind. If we display quality pictures where the user can interact and show the interest for (shopping). If image quality and representation are not up to the mark there might be more chances to loses the business or customers.

Digital Image Processing plays a very important role in education:- Via Digital Image we can transfer advanced pieces of knowledge in linear algebra, statistics, probabilities, signal processing, geometry, algorithms, machine learning, data science and software development. Digital Image can display any situation precisely eg. medical diagnosis done with more precision and accuracy instead of old-school methods of identifying based on visible symptoms leading to loss of revenue for doctors.

Digital Image Processing in Publishing world:- Nowadays every book is available on the digital platform. Peoples demand and needs are changing so having optimized digital book is need of today's generation.

In the world of business, every small and big thing is going to be analyzed. So, you will have to put in your best efforts to ensure that all the images adhere to the same professional standards. You can check out Reality Premedia offering some of the best image editing services.

Cost - Normally, a full Landsat TM scene costs $600 , making the picture within the price range of even small planning agencies for a single project. Landsat MSS imagery is about $200, covering the period from 1972 to about 1988. Tm imagery is available from the early 1980s to present. In many cases both recent and current landsat imagery can be downloaded for free from a variety of web sites. Data from newer satellites such as the Terra and Aqua satellites and many others are available for free from numerous web sites. In many cases, DOPs are available on individual state GIS data clearinghouse web sites for no cost except the download time. Increasingly, this data is available as well from the USGS Seamless Data Distribution System (search for USGS SDDS).Imagery as a poor person's data base From a cost perspective, we must think of digital imagery, whether it is satellite imagery or digital aerial photographs as a geographic data base, with spatial and spectral information unavailable from maps or other kinds of data layers. Remember that maps are largely human constructs designed to answer specific questions.

VII. DISADVANTAGES

It is more time consuming as compared to the former. More complex program.

VIII. CONCLUSION

Using image processing techniques, we can sharpen the images, contrast to make a graphic display more useful for display, reduce amount of memory requirement for storing image in for mation, etc., due to such techniques, image processing is applied in recognition of images´ as in factory floor quality assurance systems;image enhancement´,as in satellite reconnaissance systems;³image synthesis´ as in law enforcement suspect identification systems, and image construction´ as in plastic surger y design systems.

Image processing has wide verity of applications leaving option to the researcher to choose one of the areas of his interest. Lots of research findings are published but lots of research areas are still untouched. Moreover, with the fast computers and signal processors available in the 2000s, digital image processing has become the most common form of image processing and generally, is used because it is not only the most versatile method, but also the cheapest.

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