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Analysis of Image Processing and Its Challenges

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***Abstract:** Major two main areas of application. Improved visual information for human interpretation. Process image data for memory, transmission and representation for the perception of automata. The purpose of this article is to define the meaning and scope of image processing, describe the various steps and methodologies involved in typical image processing and the application of image processing tools and procedures*
***Keywords:** Image Processing, Image analysis, applications, research.*

I. BASIC

The image can be defined as a two-dimensional function f(x, y). Where x and y are spatial coordinates (planar) and the amplitude of f in any pair of coordinates (x, y) is called the magnitude or gray level. From the picture at that time. An image is said to be digital if the amplitude values of x, y, and f are all finite discrete quantities. The field of digital image processing refers to the processing of digital images by digital computers. Remember that a digital image is made up of a finite number of elements, each with a specific position and value. These elements are called image elements, image elements, pixels, and pixels. Pixel is the most used term for an element of a digital image. Vision is our most advanced sensation, so it's no wonder that images play the most important role in human perception. However, unlike humans, who are limited to the image range of the electromagnetic (EM) spectrum, cameras cover nearly the entire EM spectrum, from gamma waves to radio waves. They can process images generated from sources that humans are not used to associate with images. These include ultrasound scans, electron microscopy, and computer-generated images. Therefore, digital image processing covers many different application areas [1].

Basic steps in digital image processing There are two steps in digital image processing: one is the input and the output is an image, the other is the input is an image. image but the output are attributes. Calculations are extracted from these images. It can be classified into large areas.

Image acquisition was Interest in digital image processing methods stems the first digital image processing process. Note that recovery can be as easy as getting an image already in digital format. In general, the image acquisition step involves pre-processing such as resizing. The next step is image enhancement, which is one of the simplest and most exciting areas of digital image processing. Basically, the idea behind the enhancement technique is to get hidden details or to emphasize a feature of interest in the image. A well known example of improvement consists in increasing the contrast of an image so that it is "good". It is important to remember that improvement is a very subjective area of image processing.

Image restoration is also an area concerned with improving the appearance of images. However, unlike subjective emphasis, image restoration is objective in the sense that restoration techniques tend to be based on stochastic or mathematical models of image degradation. Improvement, on the other hand, is based on people's subjective preferences for what constitutes a "good" improvement outcome. Color image processing is an area of growing importance due to the dramatic increase in the use of digital images on the Internet. Color image processing involves the study of color models in the digital domain and basic color processing concepts. The color of an image can be used as the basis for extracting features of interest from an image.

II. INTRODUCTION

Wavelets are the basis for representing images at different levels of resolution. In particular, the wavelet can be used to compress image data to represent a pyramid. The pyramid divides the image into smaller areas. Compression, as the name implies, is a technique for reducing the storage space required to store an image or the bandwidth required to send the image. Storage technology has improved dramatically over the last decade, but the same is not true for portability. This is especially true for the use of the Internet, which features important visual content. Image compression is (probably accidentally) well known to most computer users as an image file extension, such as the .jpg file extension used by the Joint Photographic Experts Image Compression Standards Group (JPEG). Morphological processing refers to tools for extracting image components that help represent and explain forms. Morphological image processing is the first step in the transition from the image generation process to the image property generation process.

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The segmentation procedure divides an image into its components or objects. In general, automatic segmentation is one of the most difficult tasks in digital image processing. Powerful segmentation processes greatly improve the successful resolution of imaging problems that require the identification of individual objects. Weak or unstable segmentation algorithms, on the other hand, almost always guarantee eventual failure. In general, the more precise the segmentation, the higher the probability of success. The representation and description of very often occurs after exiting the segmentation phase. This is usually raw pixel data and makes up the boundaries of the area (i.e. the set of pixels that separates one image area from another) or all points within the area itself. .. In both cases it is necessary to convert the data to a format suitable for processing by the computer. The first thing you need to decide is to represent the data as a boundary or as a complete region. Representation of boundaries is appropriate when the emphasis is on the external features of the shape such as angles and refractions. Regional representations are appropriate when focusing on internal properties such as texture and shape of the skeleton. In some applications, these expressions complement each other. Choosing the representation is only part of the solution to converting the raw data into a format suitable for further computer processing. You also need to specify how you want to describe the data so that the characteristics that interest you are highlighted. A description, also known as feature selection, refers to the extraction of attributes that generate interesting or basic quantitative information to distinguish one class of features from another. Identification is the process of assigning a label (such as "vehicle") to an object based on a descriptor. Target recognition refers to how individual objects in an image are recognized.

A. Applications Of Image Processing

There are many applications of image processing in many different human activities, from remote sensing scene interpretation to biomedical image interpretation. This section briefly describes some of these applications.

B. Automatic Visual Inspection System

1) Automated visual inspection systems are essential for improving the productivity and quality of products from manufacturing and allied industries [2]. This is a brief introduction to several visual inspection systems

2) Automatic Filament Inspection: An interesting application of automated visual inspection is the inspection of the lamp manufacturing process. Bulb filaments often melt in a short time due to the wrong shape of the filament, for example, due to uneven height of the filament. Manual inspection is not effective in detecting such anomalies. The vision-based automated inspection system produces a binary image slice of the filament, from which the filament shape is generated. Analyze this template to determine the unevenness of the filament shape pitch within the bulb. One of these systems was designed and installed by Electricity Corporation.

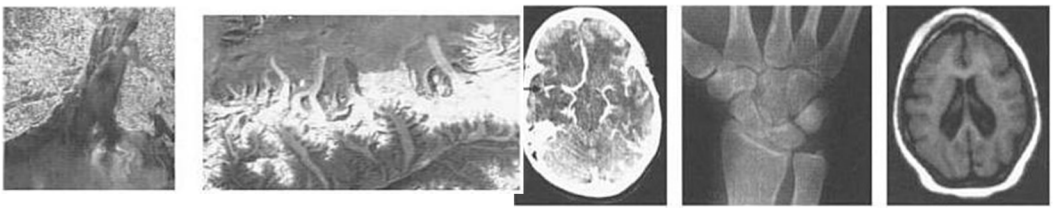
3) Identification of defective components: Automated visual inspection can also be used to identify defective components in the electronic or electromechanical system. Defective components generally generate more heat energy. Infrared (IR) images can be generated by distributing thermal energy in an assembly. By analyzing these IR images, it is possible to identify the failing component in the assembly.

4) Automated Surface Inspection Systems:

Detection of surface defects is an important requirement in many metallurgical industries. For example, hot or cold rolling in a steel plant must detect aberrations on the surface of the rolled metal. This can be achieved by using image processing techniques like edge detection, texture identification, fractal analysis, and so on.

C. Remotely Sensed Scene Interpretation

Based on the analysis satellite images are used in city planning, resource mobilization, flood control, agricultural production monitoring, etc.



Delta's of river Ganga A City scan image of brain(b)x-ray of wries (c)MRI of brain

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Visible on a normal chest x-ray is the diaphragm, which separates the ribs, thoracic spine, heart, and thoracic cavity from the abdominal cavity. These areas of the chest X-ray are checked for abnormalities by analyzing the respective segments.

1) *Identification of Heart Disease:* Quantitative measurements such as heart size and shape are important diagnostic factors in the classification of heart disease. Image analysis techniques can be used for radiographic imaging to better diagnose heart disease.
2) *Digital X-ray:* Digital mammograms are useful in detecting features (such as microcalcifications) in the diagnosis of breast cancer. Image processing technologies such as contrast enhancement, segmentation, feature extraction, and shape analysis. Used for mammography analysis. The regularity of the tumor shape determines whether the tumor is benign or malignant.

D. Defense Surveillance

The application of image processing technology to defense surveillance is an important area of research. It is necessary to continuously monitor land and sea using aerial surveillance technology.

Suppose you try to determine the type and formation of warships in an aerial photograph of the surface of the sea. The main task here is to segment different objects in the water area of the image. After extracting segments, find parameters like area, position, circumference, compactness, shape, length, width, aspect ratio and classify each segmented object. These items range from small boat use the features above to recognize and find these objects. To explain the formation of all possible ships, it is necessary to identify eight possible directions of these objects: the distribution of north, south, east, west, northeast, northwest, southeast and southwest. .. From the spatial distribution of these objects, we can explain the entire marine landscape important to the ocean. surveillance.

E. Content-Based Image Retrieval

Retrieving query images from large image archives is an important application in image processing. The advent of large multimedia collections and digital libraries has created significant requirements for the development of search engines to index and retrieve information from them. These days there are many good search engines for machine readable text, but not many quick tools for getting images with depth and color. Traditional approaches to retrieving and indexing images are time consuming and expensive. Therefore, there is an urgent need to develop image recovery algorithms using embedded content.

You can use digital image characteristics (shape, texture, color, object topology, etc.) as index keys to search and retrieve informational images from a large database of images. Such image asset-based image recovery is often referred to as content-based image recovery [8, 9].

F. Moving-Object Tracking

Tracking moving objects in order to measure motion parameters and obtain a visual record of the moving objects is an important application area in image processing (13, 1). In general, there are two different approaches to object tracking.

1) Identity-based tracking
2) Motion-based tracking.

A system developed to track high-speed targets (military aircraft, missiles, etc.) based on motion-based prediction methods such as Kalman filters, extended Kalman filters, and particle filters. In an automatic image processing based object tracking system, the target object in the sensor's field of view is automatically acquired without human intervention. With recognition-based tracking, the pattern of an object is recognized in subsequent image frames, and tracking is performed using that location information.

G. Neural Aspects of the Visual Sense

The optic nerve of our visual system enters the eyeball and connects to the rods and cones behind the eye. neurons contain dendrites (inputs) and long axons (outputs) with dendrites at the end. Neurons communicate via synapses. Signal transduction involves the diffusion of chemicals across the interface, and receptor neurons excited or inhibited by these chemicals propagate across the interface. The optic nerve begins as a bundle of axons derived from ganglion cells on one side of the retina. On the other hand, rods and cones are connected to ganglion cells by bipolar cells, and there are also horizontal neurons that connect laterally. Signals from adjacent receptors in the retina are clustered in horizontal cells to form fields that receive opposite central and peripheral responses. Therefore, no stimulus is projected on this field. Uniform light. For uneven lighting, the difference between central and peripheral lighting creates excitement. Some receptive fields use color differences such as red-green and blue-yellow, so stimulus differences apply not only to brightness but also to color. In the genital and external visual cortex, there are additional groups of receptor field responses that control the directional edges of the eye and innervation. This is a low-level process that precedes a high-level

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interpretation with an unknown mechanism. However, it shows an important role in the sensory differences underlying the contrast phenomenon. When the retina is evenly illuminated in terms of brightness and color, less neural activity occurs. The normal human retina has 6-7 million cones and 110-130 million rods. The transmission of light signals from rods and cones through the optic nerve fibers. The optic nerve passes through optic chiasm, sending all signals from the right side of both retinas to the right half of the brain and all signals from the left side to the left half of the brain. .. Each half of the brain receives half of the image. This ensures that the loss of one eye does not deactivate the visual system. The optic nerve ends in the lateral and dorsal vertebral bodies that cross the brain, from which signals are distributed to the visual cortex. The visual cortex still has a retinal topology and is only the first stage of perception when information becomes available. The visual regions of the two cerebral hemispheres are connected by the corpus callosum, connecting half of the visual field.

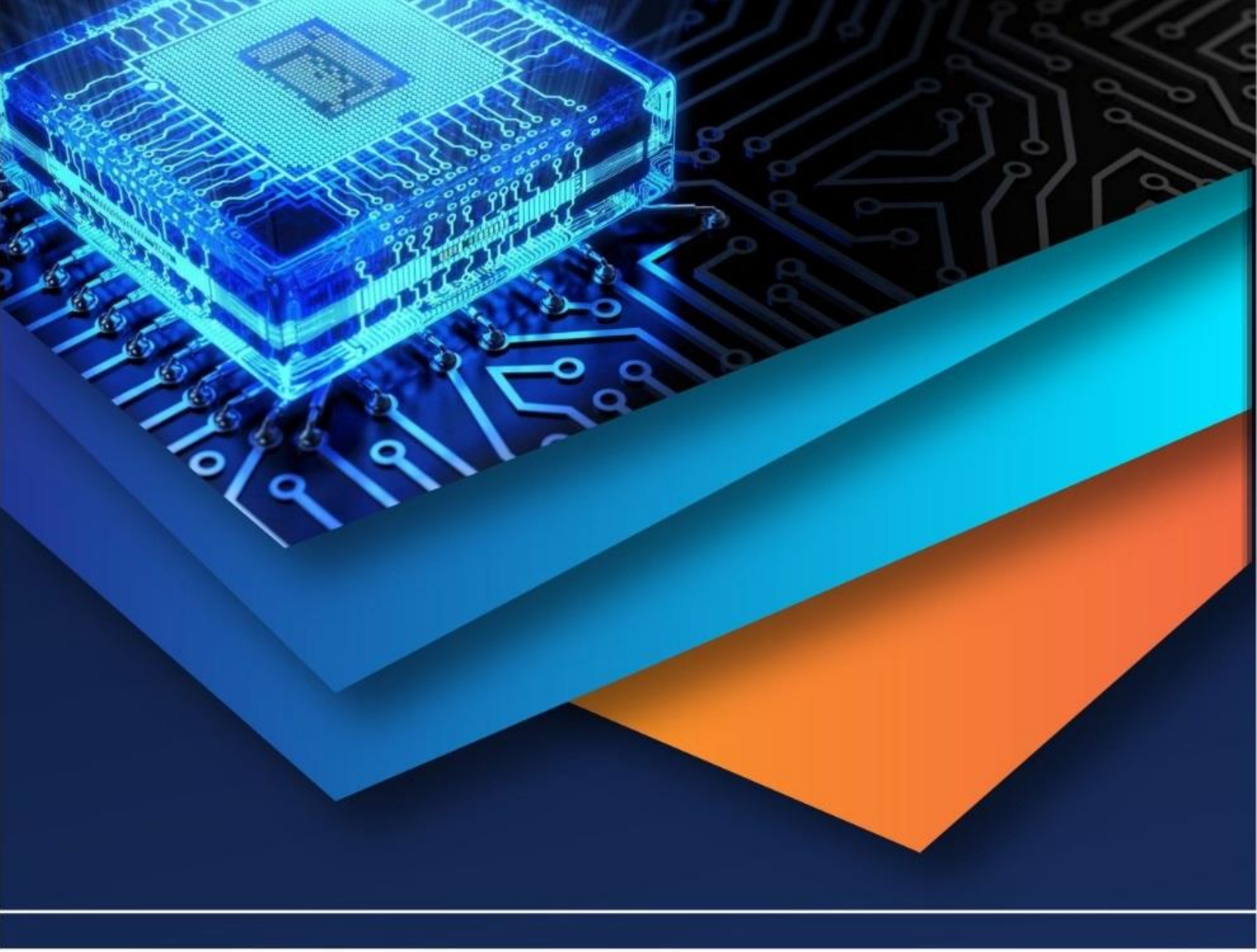
III. CONCLUSION

Image processing has many uses, allowing researchers to choose one of their areas of interest. Many research results have been published, but many areas of research are still valid. In addition, the high-speed computers and signal processors available in the 2000s made digital image processing the most common form of image processing, not just a versatile method. It is also the cheapest method, so it is widely used.

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