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Discussing Issues Faced by Image Processing and Use in Different Fields

Dr. Vijay Prakash Singh[1], Mr. S Mahesh Reddy[2], Dr. Sudhir N Shelke[3]

[1] Research Supervisor, Department of Electronics & Communication Engineering, Sri Satya Sai University of Technology & Medical Sciences, Sehore, M.P., India

[2] Research Scholar, Department of Electronics & Communication Engineering, Sri Satya Sai University of Technology & Medical Sciences, Sehore, M.P, India

[3] Research Co-Supervisor, Department of Electronics and Communication Engineering & Principal, Guru Nanak Institute of Technology, Nagpur

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Abstract

One of the most rapidly expanding areas in engineering is image processing. Enhanced visual information for human interpretation and processing of image data for storage, transmission, and representation for machine perception make digital image processing an exciting and ever-evolving area. Enhancing photographs taken in everyday life or with cameras and sensors on board satellites, spacecraft, and aeroplanes is what we call "image processing," and it has many practical uses. These days, processing images is a breeze because to high-powered computers, specialized graphics software, and other advancements. Processing images is a versatile method that may be used for analysis across many disciplines and many different contexts. The challenges that exist in the field of image processing and its applications are enumerated in this study.

Keywords: Analog, Digital, Applications, Image,Recognition

I. INTRODUCTION

We rely heavily on digital images in our daily lives. Every single minute, hundreds of millions of digital images are posted. They are a two-dimensional image's binary numerical representation. Medical imaging, video surveillance, forensics, remote sensing, etc., may all make use of digital images. Nowadays, it is more important than ever to automatically analyses images and associated signals using a variety of image processing methods. In all domains involving image enhancement, modification, and analysis, Image Processing and Computer Vision play critical roles.

In order to enhance the quality of an image, image processing is a technique that analyses and manipulates digital images. The main benefits of digital image processing

techniques are their adaptability, repeatability, and precision in preserving the original data.

To extract the necessary information from images, a method called image processing is utilized. During this procedure, images are digitized so that data may be extracted from them. Image processing serves several functions, including the detection of hidden items, the creation of clear images, the measurement of distinct things in an image, the differentiation of objects in an image, and the recognition of patterns. It contains several steps that begin with the import of images, continue with analysis and manipulation, and end with a product tailored to the user's needs.

Image processing approach may be used for processing images, 3d models, prints and to acquire the needed data from the images. In employing analogue visual approaches, researchers apply a wide range of standard image interpretation procedures. Only within the analyst's area of expertise, this form of image processing is limited. So, while processing images, analysts may combine their own expertise and data. To carry out the image processing approach in digital image processing, algorithms based on computers are created.

Taking into account the benefits of digital image processing over analogue image processing and the vast array of algorithms that may be applied to the input data in digital image processing, few difficulties during processing such as noise production, signal distortion etc., may be avoided and eradicated by pretreatment method called signal processing. In the late 2000s, digital image processing with the use of computers emerged as a more flexible and affordable method of processing images. Computer vision and computer graphics are closely related to image processing.

II. IMAGE PROCESSING

Image processing often refers to digital image processing. Analog and optical image processing are also included. We have offered a comprehensive analysis of image processing and its relevance to computer vision in this research. Imaging is the process of acquiring images. Digital Image Processing (DIP) is an interdisciplinary discipline that draws from optics, computer science, mathematics, surface physics, and visual psychophysics. Remote sensing, feature extraction, face detection, fingerprint detection, optical sorting, augmented reality, microscope imaging, lane departure warning systems, non-photorealistic representations, medical image processing, and morphological imaging are just a few of the important applications of image processing in computer vision. Sub-images called regions or areas-of-interest are present in an image. The foundation for each region in an image is often a collection of items. The majority of the time, digital copies of the original images is needed for image processing. Every sample or pixel in the input image is quantized by a predetermined number of bits during the digitization process, which samples it on a distinct lattice.

A digital image is first transformed into an analogue signal and scanned onto an output in order to be shown. Computer Vision and Computer Graphics are closely connected to Image Processing. Instead of being captured by imaging equipment from real situations, as in most animations, images in computer graphics are physically created from surroundings, physical models of things, and lighting. The ability of a computer or piece of software to comprehend the objective

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contents of an image or set of images is known as "computer vision," and it refers to high-quality image processing. For instance, movies or 3D MRI scans of the entire body. The employment of far more complex algorithms is made feasible by digital image processing, which may provide both more complex performance on straightforward jobs and the implementation of ways that would be impossible using analogue approaches. Digital image processing is the only experimental technique for:

- Classification of images
- Feature extraction
- Multi-scale signal analysis
- Pattern recognition
- Projection

According to the needs of the user, image processing can offer a variety of advantages, including the following:

- Human interpretation can be done more relevantly through much processing.
- Digital images can be acquired according to one's need.
- Information can be extracted from images for machine interpretation and to make image more suitable for further processing.
- Editing of image pixels can be done according to requirement also the contrast and density can be changed.
- Retrieving and storing of an image can be done more easily.
- Third-party provider can easily get hold of an image through electronic transmission

Goals of Image Processing

The goals of image processing are divided into 5 groups.

1. Hallucination - monitor the objects that are not visible.
2. Image restoration and sharpening - For creating a better image.
3. Image repossession - search for the image of interest.
4. Measurement of pattern – Measures a range of objects in an image.
5. Image acknowledgment – differentiate the objects in an image.

III. PRINCIPLE OF IMAGE PROCESSING

Image processing is the process of modifying image data in order to assess and improve the image's quality as much as feasible. Images are processed on a digital computer for digital image processing. Doing a series of operations on an object's numerical representation is another approach to define digital image processing. According to the architectural model above, a console, output image storage, or image recorder are not required components of all images processing systems. Depending on the requirements of the application, an image processing system may include different components.

Image Processing is of two methods.

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- **Analog Image Processing**

The method of changing images on two-dimensional signals using electricity is known as analogue image processing. Periodic and non-periodic analogue signals are both possible. The images produced by analogue image processing change over time since an analogue signal is a time-varying signal. The finest example of analogue image processing is televisions from the past, where the brightness of the picture is determined by the signal's amplitude after being received by an antenna. Changing this value will increase or decrease the overall brightness of the image.

- **Digital Image Processing**

Digital Image Processing as we know is where a physical image is captured and represented as a function of f(x, y) where x and y are the coordinate value is the image matrix and the value of the function is the intensity of the image at that point. The intensity of a pixel ranges from 0 to 255 where 0 are white and 255 are black.

Overlapping Fields of Image Processing

Image Processing is comparable to a number of other subjects. The inputs and outputs of each field differ significantly, as shown in Fig. 1.

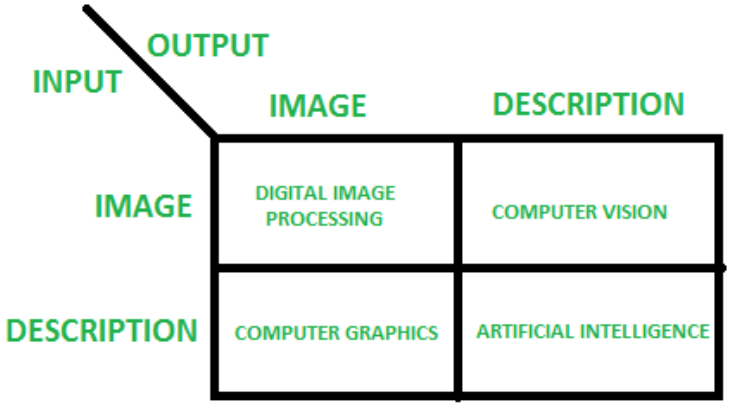

Figure 1: Overlapping fields of image processing

- **Computer Vision**

It's a subfield of image processing concerned with making sense of the data included in digital images and movies. From a technological standpoint, it is the process of developing systems to acquire what human intelligence would find difficult to obtain: an intelligent sense of understanding from images and movies. Extracting, analyzing, and comprehending data from an image or video frame are all aspects of computer vision. To acquire a visual knowledge of the image, a set of theoretical and computational foundations are required.

- **Computer Graphics**

Computer graphics is the field that deals with the creation of images using computers. The use of computer graphics has become crucial in several industries, including entertainment, engineering, medical, and many more.

- **Artificial Intelligence**

Face recognition patterns, item detection and recognition on still images, and moving video

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frames are all possible using AI in image processing. Machines and other complex pieces of engineering are becoming increasingly automated thanks to artificial intelligence. Together with many other applications, it is employed in smart home automation.

IV. IMAGE PROCESSING ISSUES

Non-Trivial Issues

Non-trivial problems are those that need extensive effort to correct, such as filtering, regeneration, restoration, categorization of images, fusion, segmentation, etc.

Accuracy

While perfect precision in image processing is impossible, it might occasionally cause small issues in applications like image recognition and handwriting recognition.

Diverse Methods of Processing

There are many different techniques and methods that can be used for processing an image, which is both a benefit and a drawback because running out of options, would force researchers to come up with a lot of fresh approaches to the problem. For instance, there are different types of filtering, such as spatial low pass and spatial high pass for Fourier representation. Fourier law and Fourier high pass.

V. APPLICATIONS OF IMAGE PROCESSING

Through diligent work and research, image processing has been applied to a variety of applications to address a variety of issues. These applications include improving image techniques, expanding space and power, and determining how the application can be applied to the current situation in an effective way. The following are a few of the applications:

Medical Diagnosis and Treatment

Image processing can be viewed as being necessary to identify a specific disease, order study a specific sample load of images, and perform image recognition enhancement analysis in the medical and dental fields. These types of techniques are used to obtain better images in the field of medicine, which will aid in achieving better results.

Magnetic resonance imaging is used to scan for issues or medical procedures using those 3-D images of the human body, and in these situations, image processing is crucial. Moreover, an improved image is obtained in order to treat any fractures. Radiography, endoscopy, stereo endoscopy, computed tomography, electrocardiography, and other applications are also possible.

Agricultural

The primary element of human existence is food, and agriculture is the process of producing food, which helps the economy of the nation. So, it would be preferable to anticipate crop growth and seed quality together with soil and all other variables involved in farming and agriculture. With the use of image processing, doing this kind of prediction is now simple.

Crop management can be accomplished with the aid of image processing by determining the seed quality and condition as well as the nutrients in the plant and fruit quality. Land estimation and inspection can also be accomplished with the aid of image processing as it maps the flow of processing

for precise agriculture by examining and tracking all the factors.

Monitoring Applications

Security may take many different forms in today's fast-paced world, but one of them is the use of surveillance cameras, which allow for the present-day monitoring of certain actions, circumstances, and locations. Yet in today's technologically advanced world, hybrid cameras are also utilized in addition to thermal imaging cameras to find flaws or human traits.

Here, image analysis and content comprehension are accomplished by taking the distinctive images from the movie by segmenting it into the appropriate sections, and then evaluating the results. Moreover, biometrics is a type of surveillance system in which bodily traits or behavioral features are extracted, recognized, and kept for a specific purpose.

Disaster Management

By collecting satellite images, analyzing landslide-prone areas, and taking action before the situation becomes uncertain, image processing plays a crucial role in disaster prevention. A variety of techniques are employed for this work, including image registration, identifying current moments, predicting and estimating the deviation, and others. For the purpose of identifying fire and volcanic eruptions, as well as the quickest path to the afflicted region, image processing segmentation based on colors can be done.

Image Restoration

Image processing is also used in image restoration to obtain a clear image and restore the original image. This may be accomplished by enhancing the image's quality and removing blur and noise.

Facial Recognition

Based on many factors, such as an individual's emotion, posture, and complexion, a hair facial pattern may be identified from a human face. The information is then stored and can be retrieved whenever necessary.

VI. CONCLUSION

Computer-aided Image processing methods are widely used throughout the industry and are also a current area of study. In addition to the subject of computer science, other areas of engineering and technology have discovered the benefits of digital image processing. In the realm of signal processing, digital image processing is both broad and flexible. It is employed in practically all scientific disciplines, is constantly expanding, and will continue to have an impact on emerging technology.

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