

Digital Image Processing Technology and Its Applications

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Abstract: - Digital Image processing is the class of methods that deal with manipulating digital images through the use of computer algorithms. It is an essential preprocessing step in many applications, such as face recognition, object detection, and image compression. This is important in several Deep Learning-based Computer Vision applications, where such preprocessing can dramatically boost the performance of a model. Manipulating images, for example, adding or removing objects to images, is another application, especially in the entertainment industry. This article focuses on the current digital image processing technology and its application status.

Key words: Digital image processing technology, Development course, Application.

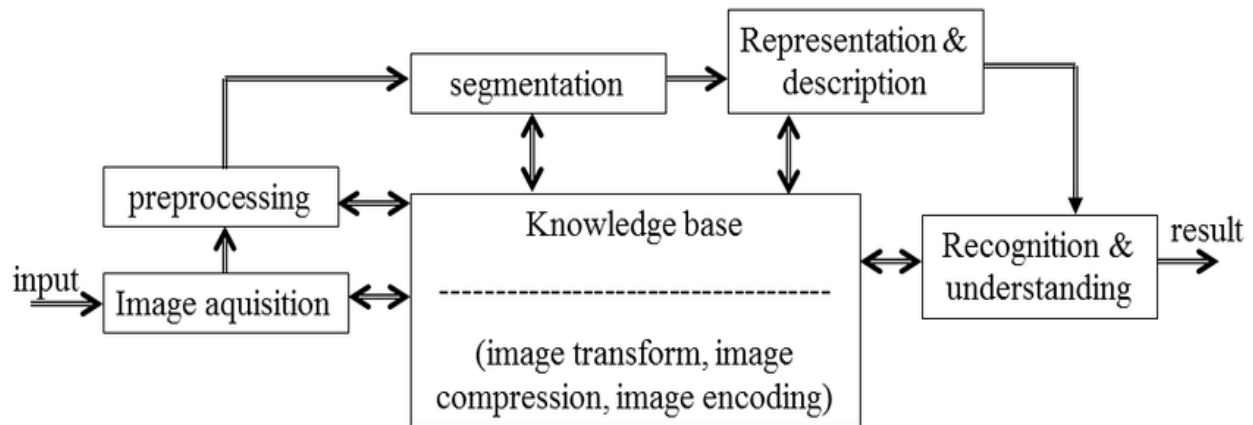
1. INTRODUCTION

Digital image processing technology is the use of computer technology to remove the image noise, enhance, segmentation, recovery and so on. The development of computer network technology has led to the development of digital image processing technology, the increasing level of mathematics, and the constant demand for digital image processing technology from various industries in society, which has brought new opportunities for digital image

technology and provided advancement. In the 1920s, human beings used digital image processing technology for the first time. They used cables to transfer photos between the United Kingdom and the United States. However, the quality of images transmitted was not very good. Therefore, image quality should be improved and optimized. As technology is continuously updated and applied to different fields, the requirements for digital image processing technology are getting higher and higher, which also accelerates the development of digital image processing technology.

2. OVERVIEW OF DIGITAL IMAGE PROCESSING

Digital Image Processing means processing digital image by means of a digital computer. We can also say that it is a use of computer algorithms, in order to get enhanced image either to extract some useful information. Digital image processing is the use of algorithms and mathematical models to process and analyze digital images. The goal of digital image processing is to enhance the quality of images, extract meaningful information from images, and automate image-based tasks.



3. FUNDAMENTAL STEPS INVOLVED IN IMAGE PROCESSING TECHNOLOGY

There are two categories of the steps involved in the image processing –

- (1) Methods whose outputs are input are images.
- (2) Methods whose outputs are attributes extracted from those images.
 - i) Image acquisition: It could be as simple as being given an image that is already in digital form. Generally, the image acquisition stage involves processing such scaling.
 - ii) Image Enhancement: It is among the simplest and most appealing areas of digital image processing. The idea behind this is to bring out details that are obscured or simply to highlight certain features of interest in image. Image enhancement is a very subjective area of image processing.
 - iii) Image Restoration: It deals with improving the appearance of an image. It is an objective approach, in the sense that restoration techniques tend to be based on mathematical or probabilistic models of image processing. Enhancement, on the other hand is based on human subjective preferences regarding what constitutes a “good” enhancement result.
 - iv) Color image processing: It is an area that is been gaining importance because of the use of digital images over the internet. Color image processing deals with basically color models and their implementation in image processing applications.
 - v) Wavelets and Multiresolution Processing: These are the foundation for representing image in various degrees of resolution.
 - vi) Compression: It deals with techniques reducing the storage required to save an image, or the bandwidth required to transmit it over the network. It has to major approaches
 - a) Lossless Compression
 - b) Lossy Compression

- vii) Morphological processing: It deals with tools for extracting image components that are useful in the representation and description of shape and boundary of objects. It is majorly used in automated inspection applications.
- viii) Representation and Description: It always follows the output of segmentation step that is, raw pixel data, constituting either the boundary of an image or points in the region itself. In either case converting the data to a form suitable for computer processing is necessary.
- ix) Recognition: It is the process that assigns label to an object based on its descriptors. It is the last step of image processing which use artificial intelligence of software.

4. DEVELOPMENT OF DIGITAL IMAGE PROCESSING TECHNOLOGY

Digital Image processing was developed within the 1960s, at Bell Laboratories, the Jet Propulsion Laboratory, Massachusetts Institute of Technology, University of Maryland, and some other research facilities for satellite imagery, medical imaging, wire-photo standards conversion, photography enhancement, videophone, character recognition. One in all the earliest applications of the digital image processing is seen within the newspaper industry in the 1920s. It had been about the photographs that were sent by submarine cable between London and New York. Now because the development of recent digital technologies got developed Digital Image Processing also get developed. Very commonly and basic used techniques in image processing are enhancement, restoration and compression of images. The very first successful application was America Jet lunar photos were sent by Space Detector Ranger 7 using this application in 1964. Techniques mainly utilized by them were like geometric correction, gradation transformation and noise resent lunar photos. It had been a giant success story to possess the successful computerized mapping of the moon’s surface. The Success of this application was noticeably progressed so spacecraft sent nearly 100,000 photos that were processed with more complex image functionalities. It helped to get the topographic map, colour map and panoramic mosaic of the moon. Because of the

computing equipment of that era the value was fairly high at that time. But it had been changed in 1970s as dedicated hardware were available and digital image processing proliferated as cheaper computers. As general-purpose computers become faster it began to occur of the dedicated hardware of all. In 2000s there have been fast computers and signal processor and thereupon digital image processing become the foremost common type of image processing. It's mostly used because it has turned to a significant computing discipline which is playing a big role to resolve reality life problems in real time.

5. APPLICATIONS OF DIGITAL IMAGES TECHNOLOGY

Almost in every field, digital image processing puts a live effect on things and is growing with time to time and with new technologies.

1) Image sharpening and restoration: - It refers to the process in which we can modify the look and feel of an image. It basically manipulates the images and achieves the desired output. It includes conversion, sharpening, blurring, detecting edges, retrieval, and recognition of images.

2) Medical Field: - There are several applications under medical field which depends on the functioning of digital image processing.

- Gamma-ray imaging
- PET scan
- X-Ray Imaging
- Medical CT scan
- UV imaging

3) Robot vision: - There are several robotic machines which work on the digital image processing. Through image processing technique robot finds their ways, for example, hurdle detection robot and line follower robot.

4) Pattern recognition: - It involves the study of image processing, it is also combined with artificial intelligence such that computer-aided diagnosis, handwriting recognition and images recognition can be easily implemented. Now a days, image processing is used for pattern recognition.

5) Video processing: - It is also one of the applications of digital image processing. A collection of frames or pictures are arranged in such a way that it makes the fast movement of pictures. It involves frame rate conversion, motion detection, reduction of noise and color space conversion etc.

6. Conclusion: - Digital image processing technology has been widely used in our lives, providing great convenience for our lives, production and research. Nowadays, with the participation of artificial intelligence, digital image processing is moving forward into the field of algorithm research, and the standardization process of related image processing technology will be carried out accordingly. Influenced by the development of artificial intelligence and deep learning, image enhancement algorithms based on deep convolution neural network is gradually proposed. This type of method can meet the needs of digital image processing both in speed and accuracy. This also shows that underwater image processing is moving towards intelligence. At the same time, in order to make the audience more extensive, convenience and miniaturization are also the difficulties that digital image processing algorithms need to overcome. In short, digital image processing technology is used in nearly all aspects of people's lives, creating great social value. With the continuous growth of human needs, digital image processing still has many new aspects to explore, and it will keep on improving and developing in a better direction.

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